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Trichomonas Disease of Cattle

Review and Laboratory Data

by

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Description of Outbreak

by

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A contagious disease of cattle carried by the bull and characterised by difficulties associated with breeding, vaginitis, endometritis, early abortion and pyometra has been recognised on the Continent for many years. The various symptoms were at first confused with those of other diseases, *e.g.*, contagious vesicular vaginitis and abortion due to other causes and often included in the general term infectious vaginal catarrh, but evidence gradually accumulated that a specific entity existed which was constantly associated with the presence of a flagellated protozoan to which the name *Trichomonas foetus* has been given (Riedmüller, 1928).

The object of the present article is to give a review of the salient features of the disease as observed elsewhere, to draw attention to the fact that it undoubtedly exists in this country and to give a full description of an outbreak in this country.

Historical.—Mazzanti (1900) in Italy was apparently the first to report the association of trichomonads with genital disease. He found them in the vagina and uterus of a heifer and two cows which were slaughtered on account of permanent sterility and gave a brief description of their characters. The contents of the uterus of the heifer, about 500 c.c., were like clotted milk. He believed that trichomonads were responsible for the sterility and named the organism *Trichomonas utero-vaginalis vitulae.* No further reference to trichomonads in connection with genital disease appeared until 1925 when Drescher reported that Hopfengärtner had in the previous year found flagellated protozoa in the abomasum of a seven months foetus, which he concluded were trichomonads. Pfenninger (1927) reported similar organisms in two foetuses aborted at seven-and-a-half and five months respectively, brucella infection as a cause being ruled out in both cases. He seems to have believed that the trichomonads were in part the cause, but came to no definite conclusion. Riedmüller (1928) reported that he had found trichomonads in nine out of 105 foetuses, of which he had made a routine examination, the protozoan being found in pure culture in two cases. Full details are given of these cases and of the organisms and details of attempts to transmit the disease artificially to which further reference will be made later. He drew reserved conclusions regarding its pathogenicity. In the same year Reisinger (1928) gave an excellent description of the disease as an entity although he did not recognise its cause and associated it with contagious vesicular vaginitis ("Bläschenausschlag"). Pissl (1929) also described a typical outbreak, although also not recognising its cause. Ernst (1929) reported the finding of trichomonads in a case of vaginitis in 1927 and, according to Riedmüller, also later with Steidle in seven samples of uterine discharge. Abelein (1929) was the first to make a large scale field investigation and to associate the disease definitely with the presence of trichomonads. In this and later reports (1930 and 1932) he gave a full description of all forms of the disease with details of breeding history and of transmission experiments, and adduced evidence from which he concluded definitely that the trichomonads should be regarded as the cause. Since 1932 numerous reports on various aspects of the disease have appeared. Reference will be made to the more important of these under the respective sections with which they are concerned. Particular mention should perhaps be made here of the work of Kust who has contributed valuable additions to our knowledge of the clinical features of the disease and of that of Witte who was the first to cultivate the organism in artificial media, and did considerable work on the transmission of the disease with pure cultures, its serology and pathogenesis.

Species Affected.

The disease is essentially one of bovines. Kust (1936), however, has recently stated that *Trichomonas foetus* has also been found in certain cases of genital disease in both equines and swine.

Distribution

The disease causes widespread loss in the southern half of Germany, Austria and Switzerland. It has also more recently been described in Northern Italy, where it has existed for some time, Roumania, Saxony, Northern Germany, Jugoslavia, France, the United States of America and Japan, and also exists in this country.

How long it has existed here and its present extent are largely matters of conjecture. The outbreak detailed here commenced in July, 1935. There is no doubt, however, that the disease existed before that time in this country.

Dr. W. H. Andrews (1936, private communication) informs one of us (A. W. S.) that trichomonads had been found at the laboratories of the Ministry of Agriculture, New Haw, in large numbers in a cow received from a herd in Buckinghamshire in which considerable

breeding trouble had been encountered, and had also been found in another herd. The history of one of these outbreaks which proved to be the same as that brought to our notice by Captain Collet* is briefly as follows.

Early in 1934 four or five animals which had been put to a bull owned by a neighbour aborted in the early stages of pregnancy, small foetuses averaging about 2 in. in length being found in their membranes in the gutter behind the cows. All the cows were tested for brucella abortion and found to be negative. A new bull was introduced, all conceived, and calved normally at the end of 1934 or early 1935. This new bull was also allowed to serve cows from outside and it was the owner's belief that the disease was introduced about two years previously (early 1935) by a cow from a neighbour who had had similar trouble. Difficulty in breeding was again recognised late in 1935, and continued until December, 1936, when a visit was made by one of us (A. W. S.). At this time seven cows, in addition to the cow removed in May, 1936, out of a total of about 30 in the herd, were not breeding normally. Two had gone over time and showed no signs of calving, typical discharge having been seen in the case of one; one, thought to be in calf, had shown frequent typical discharge but failed to calve and came into oestrum again at eleven-and-a-half months and again a month later although served. Four others had returned to the bull one or more times at intervals of one to four months. It is possible that one or more of these had aborted whilst lying out during the summer of this year, though none had been seen to abort and at the date of the visit no discharge or early abortion had recently occurred. There was no history of vaginitis or of the bull having shown any symptoms.

In March, 1935, one of us (A. W. S.) was asked for advice in regard to an outbreak of breeding trouble in Wiltshire,* eventually found to be affecting three herds, in which typical symptoms of trichomonas disease were present. The first intimation of this outbreak was that animals in one of the herds (herd A) were noticed to be frequently returning to the bull at six weeks to three months, discharging a whitish mucus for a few weeks and then coming into oestrum again. The following brief description of the outbreak is based on letters received from the owner's veterinary surgeon at the time and information gained at a recent visit.

In November, 1933, the owner of herd A bought 40 in-calf heifers as foundation stock for a farm which he had recently taken. All calved normally then and at the second pregnancy, and were again served towards the end of 1934 or early 1935 by the same bull. Early abortions followed, over 30 out of about 40 animals aborting at two to four months. Treatment was carried out by the owner's veterinary surgeon. Eighteen animals never settled again and were sold as barren towards the end of 1935. Of the twelve which settled all except one aborted again. These animals were again treated and a new bull introduced and the disease has now become quiescent. The disease was also present in two neighbouring farms B and C. The owner of herd C keeps about 30 cows many of which showed typical symptoms (early abortions and return to the bull after about three months), early in 1934, *i.e.*, from 1933 services. The owner of herd B keeps only eight or nine cows and no bull. Several of his cows showed typical symptoms and two developed pyometra. In 1933 he had used the bull from herd C and in 1934, presumably on account of the breeding trouble in herd C earlier that year, began to bring his cows to the bull belonging to herd A. It is not possible to say with certainty how the disease spread, but the facts point rather clearly to its transmission from herd C, in which typical breeding troubles were experienced early in 1934 following services at the end of 1933, to herd A which first showed trouble at the end of 1934 and early 1935, *via* herd B. The writer was not consulted until the acute phase of early abortion was over and only in regard to herd A.

The history of herd A, *viz.*, return to the bull at six to twelve weeks, whitish mucoid discharge and later abortion, naturally suggested the disease reported on the Continent and material was asked for with a view to search for trichomonads. Three samples of mucoid discharge were received, but a careful examination of these gave negative results. Since the samples had come through the post and were, therefore, nearly 24 hours old before examination and were of the mucoid kind which are well recognised as not usually rich in trichomonads, further material was asked for but was not received. Blood tests made for abortion of eleven affected cows gave negative results.

There is thus reason to believe that the disease has been in this country in an open form at least since the latter part of 1933, whilst it seems probable from various inquiries that it has been here for a much longer period. At least seven farms have been concerned and are in three different counties. No connection between the outbreaks in these three counties has been established. The understandable wish of owners not to publish their breeding troubles, of course, renders the establishment of such connection sometimes difficult.

Mr. T. J. Bosworth (private communication)

*The writer is indebted to Captain Collet and Mr. N. S. Barron, and to Mr. Pettifer respectively for their co-operation in connection with these farms.

informs me that in May, 1935, he found trichomonads in the condensation water of a tube inoculated from the stomach contents of an aborted foetus from a herd near Cambridge. They were identified by Dr. Lapage as *T. foetus*. The same tube also contained *Vibrio foetus* which was in pure culture in other parts of the body. A number of cows in the herd were subsequently examined for trichomonads, but without result, and no further trouble from either organism has since been experienced.

Local Distribution.—Although the disease, which is actively spread by the bull, may occur in herds of any size and may spread and be serious in the individual herd, it appears to have caused the most widespread loss in Alpine districts and other areas where small holdings preponderate; where the bulls are jointly owned by the village or groups of small farmers.

Incidence and Economic Loss

Some idea of the seriousness of the disease may be gathered from the following data, published during the last seven years.

Kust (1934) reported that the disease was responsible for 38 per cent. of all cases of sterility at the obstetrical clinic in Giessen (S.W. Germany). Schumann (1934), working in North Germany, where the disease had only recently appeared, found it 27 times in 129 samples of secretion. Rajcevic and Okljesa (1936) found eight out of 144 cases of sterility at the clinic at Zagreb due to trichomonads. Futamura (1935), in Japan, found 124 out of 427 cows affected, but it is not clear from the English summary whether these were all from affected herds, or how many herds were concerned. Zurn (1936) reports that ten out of 91 herds in the Wetzlar district of Germany were affected. Wagener and Greve (1935) report an outbreak that spread to all herds in a certain village in which community bulls were used before it was realised that the disease was present. Brauer (1935) finds the disease a considerable source of loss in six out of eight communes (*i.e.*, associations of farmers using the same bulls) in one area in Germany and gives figures for early abortions, pyometra and endometritis in each commune. Drescher and Hopfengärtner (1933) found trichomonads in only 9 per cent. of 655 samples received on account of genital trouble, and, therefore, regard the disease as of minor importance. Over half of the total cases remained, however, undiagnosed, and it is to be noted that most samples of uterine or vaginal material showed trichomonads, whilst trichomonas disease was second only to *Br. abortus* as a cause of abortion. Most positive cases were early abortions, 66 per cent. at two to three months, and all before the sixth month. Abelein said in 1929 that it was the most common cause of sterility in the Nonnenbach district of S.W. Germany. Choosing pyometras for further examination, he found (1932) that of 168 cases, 23 could be classed as definitely due to other causes, *e.g.*, *post-partum* infection or tuberculosis. Of the remaining 145, 144 showed large numbers of trichomonads. Twenty-two of these had aborted early. A bacteriological examination showed that a variety of bacteria were also present but "never" *Br. abortus*. The majority of the cows which had not been vaccinated were also negative to the agglutination test. Of 49 other abortions, 30, mostly early abortions, showed large numbers of trichomonads which were believed to be the cause. Riedmüller (1928) found trichomonads in nine out of 105 foetuses (8·5 per cent.), all nine being early abortions. Kust (1936) reports that 42·9 per cent. of diseased genital organs found at the slaughter-house in Mainz (9 per cent. of all cows) were affected. Heitgrek (1935) found trichomonads in 43 per cent. of diseased uteri (mostly pyometras) and in 2·6 per cent. of healthy uteri. Niebur (1935) found trichomonads in the genital organs of one out of 515 females from N.W. Germany slaughtered at Hannover, but in 3·4 per cent. of 500 females from S.W. Germany slaughtered at the same place. Mészáros (1936) found trichomonads in 39 per cent. of cases of pyometra in Hungary. Ubertini (1934) found 123 out of 125 samples of uterine pus positive for trichomonads and states that they were in pure culture in nearly all properly taken samples. Bourdić (1936) found them in seven out of 34 sterile cows, in all of four early foetuses and in nine out of 27 pyometras, but not in 30 healthy genitals. Sziklai (1933) found 15 out of 29 diseased uteri affected.

The Loss in the Individual Herd.

The loss in an individual herd is often serious and may be illustrated by a few examples. Abelein (1929) reported that in a herd which became infected and in which no other cause but trichomonads could be found, the percentage of cows in calf dropped from 96 to 26; the remaining 74 per cent. not calving normally on account of metritis (49 cases); known early abortion (six cases), or pyometra (twelve cases). Cameron (1935) cites one herd of 75 adults in the United States of America in which, over a period of 15 months, there were nine observed abortions, seven "abortions unseen" and eight cows and four bulls temporarily sterile, while eight cows had to be suspended on account of infection. Three were infected but calved normally, and five had symptoms, but trichomonads were not found. Walsh, McNutt and Murray (1934) give a table of the breeding records of a herd, which they freed from infection. Before the outbreak 195 matings produced 128 calves, with an average of 1·5 matings per calf; during the outbreak

133 matings produced only 25 calves with an average of 5·3 matings per calf, whilst, after the outbreak, 97 matings produced 50 calves, an average of 1·9 matings per calf.

Gould states that in the herd described, which was a valuable herd numbering about 30 head of milking stock the loss amounted to over £2,000.

Morphology

The appearance of *T. foetus* in unstained preparations was naturally described by all the earlier observers and there seems no reason to doubt that all were describing the same organism. More detailed studies of its morphology are to be found in the articles by Riedmüller (1928), who gave the first full description, Witte (1933), Gehring and Murray (1933), Wenrich and Emmerson (1933), Futamura (1935) who gives photographs of colonies on artificial media, and Diernhofer (1936), who describes certain changes in morphology which he observed after incubation in a special medium for several weeks.

The following description is based on material from several sources, but mainly from that obtained from the animal known as "fawn cow" (*see* Gould, description of outbreak) from which the microphotographs (Figs. 1, 2 and 3) were obtained. A line drawing (Fig. 4) is also given because it is difficult to get individual protozoa for photography which show all details at one time or depth of focus and are well stained. Fig. 1 was obtained from an unstained preparation.

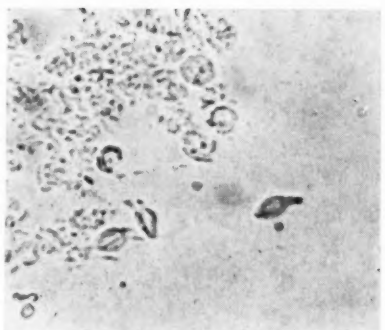
Trichomonas foetus is a flagellate protozoan which varies somewhat in size and shape according to its age whether seen in natural discharge or in culture, and the character of the discharge. It is usually pear-shaped, egg-shaped or spherical, slightly flattened dorso-ventrally and slightly pointed at the hinder end. In the actively motile state, *e.g.*, in the non-mucoid uterine discharge or in fresh cultures, it usually appears pear-shaped or fish-like, 8 to 18μ (majority about 12μ) in length and half as broad (majority about 7μ), *i.e.*, definitely longer but a little less broad than the polynuclear leucocytes which are generally present in large numbers in uterine discharges. The anterior flagella, three in number, each about as long as the body, arise near its front end, whilst a fourth filament arising a little behind the anterior flagella runs back over nearly the whole length of the body, to which it is attached by a vibratile or undulating membrane, to end in a shorter free flagellum at the hinder end. The vibratile membrane is characteristic and is the last part of the organism to become non-motile in ageing material. Movement is definite and rapid in fresh material, the organism swimming and diving in all directions, and is attained by lashing of the anterior flagella backwards and of the posterior flagellum against the tail end of the organism. This latter movement is best seen in old material in which the trichomonads also tend to move in circles.

In mucoid material such as is common in cases of chronic infection all movements are markedly decreased. The vibratile membrane, however, often moves characteristically when all other signs of movement have disappeared. At other times, however, its movements give the appearance of pseudopodial processes. The posterior flagellum also often remains motile after the anterior flagella have become quiescent. The less active forms are more rounded or egg-shaped and frequently show a sharp projecting point at the posterior end, the tip of the axostyle. In old material or cultures, forms are also often seen (and may in fact almost predominate) in which there is a constriction near the hinder end giving it an appearance almost like an hour-glass. The hinder bulbous portion of this is quite distinct from the particles or cells which are at times found attached to the projecting end of the axostyle. All of the above characters can be recognised in unstained preparations and are best seen at a magnification of about 400 diameters. The details are most easily observed in material which is not too fresh, *i.e.*, in which the trichomonads have lost some of their original activity. When material containing the organisms is suspended in a weak solution of one of the so-called vital stains, *e.g.*, neutral red, the dye is quickly taken up and appears as reddish brown granules in the cytoplasm. Motility is also gradually reduced and structures such as flagella more easily seen. Weak iodine solutions which quickly stop movement also assist in the recognition of flagella, nucleus, etc.

Stained Preparations

Fixation and Staining.—The making of good stained preparations is not easy, and various methods have been used. In methylene blue, carbol-thionin and Gram preparations made in the usual way, the trichomonads are generally unrecognisable. Riedmüller (1928) used wet-fixation in Schaudinn's sublimate-alcohol for twelve hours, followed by Giemsa's method for 12 to 24 hours. Gehring and Murray (1933) used thin films air-dried and fixed at once or later for 30 minutes in methyl alcohol. Wenrich and Emmerson (1933) fixed in Schaudinn, Hollande's or chrome-acetic and stained with iron-alum haematoxylin or Giemsa (wet method).

Various methods were used here, including fixation in the dry or moist state with osmic acid vapour, Bouin or methyl-alcohol and staining with Giemsa or Heidenhain's iron haematoxylin. Only a few satisfactory preparations were, however, obtained and in a given film only a small proportion of the organisms were



×400

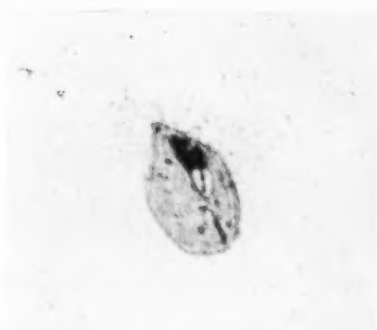
FIG. 1

Unstained preparation of pyometra material showing *T. foetus* and polynuclear leucocytes.

×1,000

FIG. 2

T. foetus, stained Giemsa



×1,600

FIG. 3

T. foetus, stained Giemsa

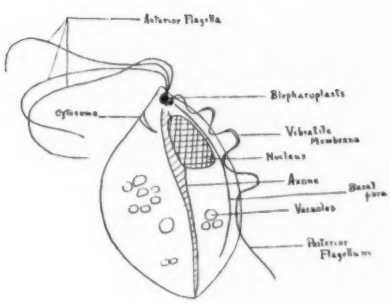


FIG. 4

Line drawing, showing essential features.

suitable for examination. This difficulty of obtaining satisfactory stained preparations has been noted by all workers. The preparations from which the photographs (Figs. 2 and 3) were obtained were fixed whilst moist, with May-Grünwald (a methyl-alcohol fixative which also stains slightly) and stained with Giemsa for about 30 minutes.

Morphology of Stained Preparations.—Suitable staining shows (Figs. 2 and 3), in addition to the structures described, an oval nucleus, an axostyle and several blepharoplasts, whilst Wenrich and Emmerson (1933-4) also describe a costa and (in preparations made with iron-haematoxylin) a parabasal body. The nucleus is situated between the axostyle and the point of attachment of the undulating or vibratile membrane. It is oval, about one-third as long as the body of the organism, and may show more deeply stained bodies. The axostyle extends through the long axis and bears posteriorly a fine "spicule" which in the rounded forms is the only part which protrudes. It is usually straight or slightly curved, and has a somewhat bulbous enlargement opposite the nucleus. The blepharoplasts appears as deeply-staining granules at the anterior end, from which the flagella appear to arise. In addition to these structures, it has a cystosome or mouth, seen only in certain preparations, and in many cases the cytoplasm, which is web-like, vacuolated and stains a faint bluish colour, shows numbers of deeply-stained granules. Division forms showing two nuclei or division of the axostyle and two sets of anterior flagella have been seen, as well as forms showing many nuclei and flagella. Division is probably by binary fission, but some difference of opinion exists as to the actual mechanism.

Demonstration of *Trichomonas foetus* in Fresh Preparations

For the purpose of diagnosis unstained preparations are best, and should be examined soon after the material is taken. A small drop of material free from faecal contamination is examined as a hanging drop preparation or between slide and coverglass with the one-sixth inch lens In suitable cases the trichomonads will at once be seen swimming actively in all directions. In others, long search may be necessary. Once seen, however, these organisms are characteristic and easily recognised. The vibratile membrane quickly catches the eye, whilst one or more of the anterior flagella can usually be seen. Stained preparations offer no advantages for diagnosis. In fact, the organisms, being no longer motile, are much more difficult to distinguish.

If material cannot be examined for some hours, it should be kept as near body temperature as possible (*e.g.*, the waistcoat pocket) or if many hours have elapsed in cold weather and negative results are obtained, put into a warm place for several hours. An incubator is, of course, used when available (as, for example, in a laboratory). It must be emphasised, however, that material should be as fresh as possible, *e.g.*, in one case Mr. Gould sent material in which he had actually seen trichomonads, but on receipt the following day (March 20th) none could be found or cultured. Material which, when fresh, contains very few trichomonads, can be enriched by overnight incubation with or without the addition of nutrient broth if taken without gross bacterial contamination.

Diagnosis is usually easy where an abortion has recently occurred. Trichomonads may be demonstrable in the fourth stomach of the foetus and/or in the uterine discharges in large numbers. As the discharge clears up the organisms quickly become less numerous (*e.g.*, in the black heifer which aborted, they had disappeared within a week and were not found again, in spite of numerous examinations). They are also easily found in pyometra material. Treatment by antiseptic irrigation, of course, makes it unlikely that trichomonads will be found (*e.g.*, the ten samples referred to by Mr. Gould taken from treated cases in which no trichomonads could be seen within a few hours after taking the samples). In chronic cases without marked metritis or pyometra and in bulls, the difficulty of detecting the trichomonads is a very real one, and it should be emphasised that several examinations are necessary before any assurance can be felt that they are absent. They may be present one day and not the next and then again appear, and so on (Emmerson, 1932, and Kust, 1934). Oestrum is said by many to be the best time at which to search for them, and Kust (1934) recommends examination of suspected or treated cows in the early part of oestrum before service. In chronic cases the difficulty of diagnosis is often made greater by the fact that the discharge is often very mucoid and the movements of the trichomonads correspondingly decreased.

History and Symptoms

The first indication that the disease is present is often breeding difficulties in general or the fact that several animals have returned to the bull after having passed one or two periods and been thought safely in calf. Sometimes a slight discharge may have been noted from the vagina. Then, if the cattle are housed, a small foetus a few inches long may be observed in the gutter. Frequently, however, the disease has not been recognised until a large part of the herd is affected and cases of abortion are numerous or pyometra observed. It will probably have been noted that the disease is associated with a particular bull. Any of these occurrences should raise the possibility of Trichomonas

disease. Cases of pyometra are particularly suggestive and the parasite easily demonstrated if present.

In the earlier part of an outbreak abortion is often more common than pyometra; cases of pyometra do not usually appear until late in an outbreak. The development of the various symptoms varies in individual animals and outbreaks. In a typical case where the infection has been produced artificially or has occurred in a cow known to be previously clean the disease may take any of the following courses. A few hours after service there is, according to some observers, *e.g.*, Kust, frequently distinct inflammatory change in the vulva which may be swollen and reddened and unduly sensitive. After one to three days vaginitis may follow, associated with a small amount of nearly clear mucoid discharge often containing small white flakes, in which the trichomonads may be demonstrable. At this time and subsequently many workers describe small seed- or corn-like reddish lesions in the mucous membrane, though others do not regard these as diagnostic. According to some, the vaginal mucous membrane, especially near the cervix, has a characteristic raspy feel. Others deny that this symptom is of diagnostic value. These symptoms disappear after four or five days and may be slight and pass unnoticed. The infection may then follow one of three courses. Firstly, a chronic endometritis may develop; secondly, conception may occur and be followed by death of the foetus and abortion; or, thirdly, the foetus may be retained *in utero* and pyometra supervene. If endometritis occurs at once conception does not usually take place and the animal again comes into oestrus at three weeks or irregularly and, although served at each period, fails to conceive. Such cases may not be easy to diagnose even at oestrus. If conception takes place and abortion follows, the abortion generally occurs between the first and fourth months, the foetus corresponding in size, *viz.*, less than one inch to six to nine inches in length. It is generally expelled in the intact membranes, all signs of putrefaction being absent both in the foetus and fluids. It has a slight flat or stale, sweetish odour and is little altered in colour. Trichomonads are at this time present in large numbers in the uterine discharge and membranes and also usually, though not always, in the stomach and various other organs of the foetus. Such cases frequently clear up quickly (*vide* later "black heifer"). The animal, though untreated, often comes into oestrum again after three weeks and commonly conceives and calves normally. In other cases, endometritis may develop or conception take place and abortion again occur early in pregnancy. Such animals are a hidden source of infection for the bull. If conception takes place and the foetus dies *in utero* but is not expelled, pyometra develops. In such cases nothing amiss may be suspected until nine months or more have elapsed since the last service (*vide* "fawn cow"). The animal appears to be pregnant and it is not until the expected date of calving is well passed that an examination is made. It may then be found that the uterus is enlarged to the size of a cow in advanced pregnancy, but that no foetus can be palpated. The os is generally shut and a plug appears to be present. When such a cow (*vide* "fawn cow") is killed the uterus is found to be filled with thick, nearly odourless pus, rather like colostrum or more whitish and glutinous. Or in other cases it may be like less glutinous pea soup or of a brownish or even chocolate colour. In this the trichomonads are easily demonstrated. Cases have been recorded in which the volume of pus reached nine gallons. In this pus may also be found remnants of a foetus or membranes; or if death has occurred early they may be entirely absent, having presumably been completely macerated *in utero*. Endometritis is, of course, also present and in fact no clear line of demarcation exists between the two conditions, the presence or absence of which will depend partly on the condition of the *os uteri*. During the development of the pyometra and particularly after some months, discharge may be noticed on the animal's tail or in the gutter or bedding behind her, but it may not be large in amount and no particular attention be paid to it until absence of calving brings the animal under closer observation. In cases where the ovaries can be palpated, a corpus luteum can, according to some observers, be felt as in a normal pregnancy. The uterine wall is thickened, sometimes to a marked degree. Observers differ somewhat with regard to the feeling of the uterus on palpation. Daust (1934) is in agreement with some other observers when he describes a uterus which is atonic, flaccid and fluctuating (associated with a soft, spongy cervix and usually a vaginal discharge with pus flakes) as nearly diagnostic. Enlargement and asymmetry are also said to help in diagnosis. Gould (*vide* later), however, finds that a particular and peculiar tenseness of feeling is diagnostic, if present, though this apparently varies from week to week, for reasons which are not yet clear.

Character of Discharge.—The character of discharges varies greatly, from discharge which is very similar to that normally noticed at oestrus, but contains small white flecks or flocculi, to one which is still very mucoid, but half of which consists of whitish or yellowish-white tough clots, or one which more resembles bad mastitis secretion or colostrum. Discharges like pea soup or of a pronounced brown or even chocolate colour have also been described.

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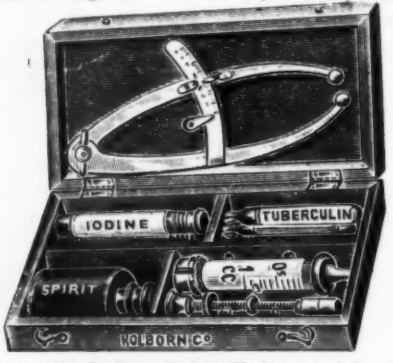

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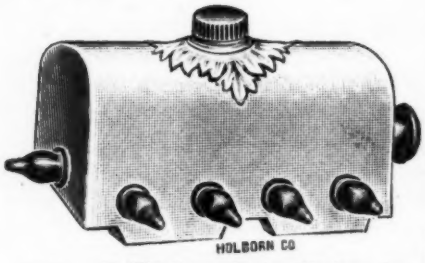

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Methods of Infection and Spread and Organs Affected

There is general agreement that the disease as it occurs in outbreaks is a pure venereal disease, and, until recently, it was believed that the trichomonads were confined to the genital organs of both sexes and the foetus, which may show a general infection. They have also been found in urine. Kust (1936), however, reports that they have been found by a recently-introduced cultural method in the blood stream of animals known or suspected, on clinical grounds, to be infected and also in a few instances in young adults believed to be free from the disease. In one case they were thus found in the prepuce of a young bull which had been artificially infected 20 days before, although trichomonads had not been found in the prepuce by microscopical examination. No evidence has been found that the trichomonads form cysts or live in the outer world for any length of time. Their possible likeness to a trichomonad present in the rumen of cattle will be discussed later. Walsh, McNutt and Murray (1934) pastured a heifer which was discharging heavily-infected pus freely, for several months with normal cows and calves without obtaining any evidence of spread. It is, therefore, usually possible to trace the infection of fresh farms directly to another farm. The use of a neighbour's bull or acceptance of his cow for service, the use of a community bull or a newly-purchased cow are the common methods by which the disease is introduced.

In order to get over the difficulty of possible infection of a clean bull by using him to serve treated cows or others which are suspect, Götze (1934) has suggested artificial insemination. Kust (1936) reports that out of 500 bovines thus inseminated 72 to 75 per cent. conceived. He does not, however, state whether these were known healthy cows, suspect or treated cows.

The Bull

All observers are agreed that the disease is transmitted by the bull at service. Symptoms may or may not be noted. Some observers, *e.g.*, Kust (1933, 1935, etc.), believe that bulls usually show symptoms soon after infection, but that the disease soon becomes chronic and that in this stage no symptoms, or at most an occasional discharge, are to be seen. Other observers make no reference to symptoms in the bull. Kust's view is based on artificially-infected bulls as well as on field evidence. His conclusions are that newly-infected bulls soon show more or less swelling of the prepuce with some discharge, the tuft of hair at the end of the prepuce being erect, and that they exhibit pain in urinating or at service and are in consequence disinclined to serve. If the penis is withdrawn under sacral anaesthesia it is found to be reddened and small red nodules like small seeds are found in the mucous membrane. Trichomonads can, after a few days, be found regularly. The condition then becomes chronic, all evidence of pain and swelling disappearing, though a slight discharge may be apparent from time to time. At this stage trichomonads are few and often very difficult to demonstrate, but the animal may still be infective. Feiling (1935) reports that trichomonads are easily found in semen obtained artificially in some bulls, though not in others.

Kust puts forward the view that bulls which are used for service in the acute stage commonly cause early and severe vaginitis, but that conception commonly occurs followed by early abortion or pyometra. In his opinion, bulls in which the disease has become chronic, on the other hand, more frequently cause endometritis and sterility. All workers are agreed on the difficulty of deciding whether a bull is infective or not, except on his service record, and there is a widespread feeling that a bull which has once been infected should never again be regarded as safe.

CONTROL AND TREATMENT

There is a general consensus of opinion that the treatment of individual cows without adequate preventive measures is useless. Control measures must vary in their details from farm to farm, but are based on the following essentials:—

(1) The keeping and use of an accurate service register for bulls and cows.

(2) Examination of all mature females which have had any chance of infection or are suspect for any reason, *e.g.*, which do not come regularly into oestrus.

(3) The provision of an unused bull (or one which can have had no contact with affected females) for the unserved heifers.

(4) The suspension of all other service for six to eight weeks.

(5) Treatment of all affected females, and of all bulls regarding which any doubt exists if they are to be kept.

(6) No cows to be sent to a neighbour's bull or cows accepted for service, and no cows sold other than for slaughter.

(7) When service again begins it is often suggested that, as a preventive measure, all cows should be examined before service, though in practice this would be difficult of realisation. Similarly, it has been recommended that the bull should be treated after each service.

(8) Finally, when the herd is clear all care should be taken against introduction by way of a neighbour's bull or of his cow or by purchases, and that all cases of

genital or breeding trouble receive prompt and expert treatment.

Therapeutic Treatment

No specific treatment is available and treatment of endometritis and pyometra has often followed the usual lines—removal of uterine contents and injection of Lugol's solution with a single- or return-flow catheter. Chinosol and entozon have also been much used for douching or uterine irrigation, whilst zinc sulphate, boric acid and bol alba, 1 : 4 : 5, has commonly been used for vaginal application.

For uterine irrigation, Cameron, Fincher and Gilman (1933), on 25 females, used "Zonite" (apparently a chlorine solution) followed by 3 per cent. Lugol's at five- to ten-day intervals with daily vaginal douches. Stone (1935) and Gilyard (1935) followed the same method. They report that the trichomonads usually quickly disappear, but have remained in some cases up to four months. They doubt if the treatment of bulls is worth while. Schumann (1935) treated 35 cows with pyometra in a herd of 64 cows with Lugol's solution 1 : 3 : 100; 22 again became pregnant. Sontgen (1935) also used Lugol's. Kubesch (1935) used 1 : 2 : 100 Lugol's or 1 : 1,000 entozon or chinosol. Schaaf (1935) removed the contents of the uterus and injected 100 c.c. of 3 per cent. Lugol's solution. Daust (1934) irrigated with saline and then with 1 : 1,000 chinosol or 1 : 1,250 entozon. Kust (1934) irrigated with 1 : 1,000 chinosol. Emmerson (1935) injected pituitrin to cause uterine contraction and then irrigated the uterus with "strong" sodii bicarb.

For bulls similar agents have been used, some preferring one, some another, with obvious reason.

Few workers give figures or details regarding the cases treated and it is difficult to get any evidence from the literature that any one agent is superior to another. It has also to be borne in mind that in many cases cure occurs spontaneously. This, coupled with the difficulty of being sure that the disease is cured, because microscopic examination of chronic cases is so variable in its results, is probably responsible to a large degree for the lack of knowledge in regard to the best method of treatment.

Many workers have recommended the expression of the corpus luteum to induce oestrus, and Abelein (1932) is of the opinion that ovarian manipulation has achieved its greatest success and popularity in districts where trichomonas disease is most widespread.

Resistance of Trichomonas to Physical and Chemical Agents

Physical Agents.—Encysted forms have not been recognised. The vegetative forms found in diseased material do not remain alive for long outside the body although the actual time varies rather widely according to different workers. In the authors' experience they often remain alive for several days at body temperature, motility gradually decreasing, for nearly a week at room temperature (15 to 20° C.) and for up to a fortnight in cold store (plus 4° C.). At body temperature and in a warm room they may remain active for several days, but in the cold soon become non-motile, though motility again appears after placing at body temperature overnight. Loss of motility and death may, however, occur much more quickly. These findings agree with those of most others. Drescher and Hopfengärtner (1933) *e.g.*, state that they may live only twelve hours at body temperature in natural materials. Rajcevic and Okljesa (1936) find, on the other hand, that they may live for 28 days at room temperature. At 56° C. they are killed in a few minutes. They are killed by direct sunlight within 24 hours (Senna, 1936).

Resistance to Chemical Agents.—Senna (1936), reports tests of the resistance of *Trichomonas foetus* to 53 different agents, using as an indicator, motility and the possibility of obtaining subcultures after various periods. He tabulates these agents in order of their activity. Amongst his findings are that they are killed within one minute by hydrarg. biniod. 1: 10,000; hydrarg. perch. 1: 2,000; salicylic acid or iodine 1: 1,000; cresol, acetic acid, sodium hydrate, or pot. permang. 1: 200; formalin, lysoform or phenol 1 per cent.; silver nitrate 2 per cent.; creolin 4 per cent.; protargol, sodii bicarb. or rivanol 5 per cent.; Lugol's solution or sodium chloride 10 per cent. Further, that they are killed in three to five minutes by 10 per cent. boric acid or 20 per cent. zinc sulphate. In Senna's experiments, trypaflavine, entozon, bichromate of potassium, and hydrogen peroxide, all took much longer even at high concentration. Many other less common agents were also tested. The comparative activity is, however, in some cases surprising and strongly suggests the need for confirmation. In the meantime, however, the low activity of entozon which is recommended by some observers, of boric acid and zinc sulphate (the components of many vaginal powders) and the relatively low activity of Lugol's solution 10 per cent. (the exact concentration of iodine meant is not clear, ? 0·1 per cent.), is worthy of note. For genital application he recommends salicylic acid, perchloride of mercury, lysoform, permanganate of potash or bicarbonate of soda; for stalls, etc., mineral acids, caustic soda, creolin or carbolic acid.

Artificial Cultivation

Abelein in 1932 reported attempts to obtain cultures of *Trichomonas foetus in vitro*, but although he got multiplication did not succeed in obtaining pure cultures.

Witte (1933) was the first to obtain pure cultures. He tested a series of artificial media and concluded that growth was best maintained in broth containing 5 to 10 per cent. of blood. Good growths also occurred in the condensation water from egg medium, to which a drop of blood had been added. Serum-broth was also useful, particularly after the organisms had been accustomed to artificial media. Three pure cultures were maintained from 59, 63 and 50 passages respectively, one for over 215 days, while three others are mentioned in a footnote to the article.

Gehring and Murray (1933), following Witte, obtained multiplication in various media, but preferred to maintain cultures in Locke's egg medium with blood and 1: 10,000 crystal violet. In this medium they carried cultures through

30, 10 and 5 transfers respectively, covering periods of 64 days, nine weeks and five weeks.

Futamura (1935) isolated the organism by cultivation in serum-glucose-gelatin agar containing gentian-violet 1: 150,000 or 200,000; and by streak culture on serum-glucose-agar. On this medium colonies, of which illustrations are given at natural size and magnified 600 times, appeared in about five days. He states that the optimum temperature is 38° C. and optimum *p*H 7·0.

Diernhofer (1936) used a medium prepared from uncontaminated pyometra pus. Two or three per cent. chloroform is added, and the flask corked and left for 14 days or longer, shaking on each of the first three days. Four volumes of broth are then added to the supernatant. This medium is then tubed and covered with liquid paraffin, warmed in a water bath and put at once into a vacuum jar, which is extracted, and kept boiling until all chloroform is removed. It is then incubated for a week, and tubes are generally found to be sterile. He finds that in this medium, the trichomonads become larger and broader, the undulating membrane is lost within 4 to 14 days, and trichomonads as such are no longer recognisable. Later, motile forms again appear in enormous numbers. They are very small, nearly bacillary in slenderness, and like small fish. After a few days, normal forms appear together with many abnormal forms, biscuit-shaped, cylindrical, etc.

Cameron, Fincher and Gilman (1933) were able to detect infection in several bulls, which were microscopically negative, by placing a swab from the prepuce in saline containing 0·5 per cent. Loeffler's dehydrated blood serum and incubating at 37° C. overnight.

Cameron (1935) reports tests of various media, serum saline, serum citrate, broth and Locke's egg saline, but was not able to maintain growth for more than 20 days.

All workers are agreed that bacterial contamination is difficult to avoid except in the case of aborted foetuses or *post-mortem* in cases of pyometra (in many of these, however, other bacteria are present during life) which makes the isolation of the trichomonads in pure culture very difficult on account of the more rapid growth of bacteria in general. Two useful methods have, however, been recently described which may be of value.

Glaser and Coria (1935) describe the cultivation and purification of the trichomonads in special "V" tubes containing 15 c.c. of a medium composed of 50 c.c. Ringer's solution, 3 c.c. of 2 per cent. Ringer agar and one drop of defibrinated blood. One arm of the "V" tube is inoculated and after 16 to 20 hours at 16 to 20° C. seed material is removed from the other arm, and transferred to egg-blood medium made with Locke's solution (L.E.B.) or with Ringer and incubated at 36° C. Optimum growth is obtained after four to eight days and transfers made fortnightly.

Kust (1936) describes the use of a modification of the method of Boeck and Drbohlav (originally used for *Entamoeba histolytica*) used by Wagner for cultivating *Trichomonas vaginalis* of the human subject. The medium consists essentially of coagulated horse serum ("not heated above 80° C. for two hours") covered with a 1: 10 dilution of egg-white in buffered saline (2 to 3 c.c. per tube) to which is added one loopful of sterilised starch. The addition of 1: 10,000 trypaflavine helps in keeping down bacterial growth. Preferably the liquid portion should be changed daily. Optimum growth occurs in three to four days and transfers should be made weekly. By using this method Kust has obtained cultures in 63 animals suspected of trichomonad infection, in 48 of which microscopical examination had been entirely negative.

The method described by Kust is similar to that of Dobell and Laidlaw (1926), who introduced the use of solid rice-starch for the cultivation of *Entamoeba histolytica* and devised other important modifications. Dobell and Laidlaw emphasise, however, the importance of not heating the medium at 80° C. for more than one hour to one hour and ten minutes.

Serology

Serological investigations have been made by Riedmüller (1932) and Witte (1934), in order to determine whether circulating antibodies were developed during infection and, if so, whether search for such antibodies could be used for diagnosis.

Riedmüller (1932) employed a complement-fixation method. He used as his antigen peritoneal exudates from guinea-pigs which had been artificially infected and were killed *in extremis*. The exudate was collected and the trichomonads centrifuged out, washed and shaken for 40 hours with beads. The resulting mush was again centrifuged and the clear supernatant used as antigen in half the inhibitory dose with four M.H.D. of complement.

Two typical cases of Trichomonas abortion unassociated with other bacteria gave positive results, whilst 14 trichomonad-free cows, ten oxen and numerous normal guinea-pigs gave negative results. The cows remained positive for four weeks and eight to twelve weeks respectively.

Witte (1934) also employed a complement-fixation method, but used pure cultures of *Trichomonas foetus* as his antigen.

Good growths in serum broth from several strains, generally five, were mixed and centrifuged. The trichomonads were washed twice with saline, diluted 1: 10 in carbol-saline, shaken with glass beads for eight hours and again centrifuged. The supernatant was used, preliminary titration being made to find a sufficient but non-inhibitory dose. Four and 10 per cent. antigen gave satisfactory results, whilst in seven cases 0·01 per cent. antigen was positive.

Eighteen infected cows, nine which had aborted and nine cases of pyometra, gave in most cases positive results, but many were very weakly positive. Twenty-seven tuberculous cows, 18 cows which were positive from Brucella abortion and 32 normal cows, all gave negative results. Witte noted that the test did not give specific results in guinea-pigs.

It should be noted that all of the animals affected with Trichomonas disease were positive microscopically, so that the complement-fixation test (with either peritoneal exudate or pure cultures as antigen), although specific in the cow, is not very sensitive and in any case, so far as evidence has so far been brought forward, offers no advantages over direct microscopic examination of unstained material. No observations have been made on animals which, though infected, are microscopically negative for long periods or except Witte (two cases), on the time during which an animal remains positive after the trichomonads have permanently gone. Witte (1934) also tested the value of the agglutination reaction and of Rieckenberg's phenomenon and found neither of value. The trichomonads are apparently

agglutinated by normal bovine serum although curiously not by guinea-pig serum.

Summary of Facts on Which the View that *Trichomonas foetus* is the Actual Cause of the Disease is Based

The Absence of Trichomonads Except in Affected Herds

Abelein, Kust and Witte have all made general statements that *Trichomonas foetus* is not present in the outer world, whilst Abelein (1932, 1934), Witte (1934) and Cameron (1935) have all failed to find trichomonads in material from unaffected herds, or from an unaffected portion of an infected herd having a separate bull. Many searches have also been made in similar conditions in which some known pathogenic agent is present. Witte (1933) failed to find them in cows showing "*Bläschen-ausschlag*"—contagious vesicular vaginitis. Abelein (1932) did not find them in "more than 100 cases of *post-partum* catarrh," or in 13 cases of *post-partum* pyometra. He only found them once in 20 abortions which occurred after half-time. He failed to find them in the course of a "quarterly examination" of 39 bulls in healthy herds.

Searches of normal organs have been numerous. Thus Weidenauer (1930) failed to find them in 85 healthy uteri; Kohl (1933) in 40 normal cows, 20 of which were slaughtered and examined *post-mortem*; Sziklai (1933) in 28 normal uteri; and Bourdié (1936) in 30 normal uteri. Heitgrek (1935), however, found them in 2·6 per cent. of 37 healthy uteri, whilst Kust (1936) states that he has found trichomonads in the blood not only of a large number of affected or suspect animals but also several times in unserved cattle. The proportion of positives in unserved cattle is not given.

Thus, whilst trichomonads would appear to be absent from most normal animals and organs, the recent report of Kust (1936) on the detection of trichomonads indistinguishable from *T. foetus* in blood clearly makes it desirable that a further large series of normal animals should be examined to find how often it is present in the blood of normal animals and in what other organs it may be found.

The Finding of Pure Cultures or of no Other Pathogenic Agent in Many Cases

Cases in which trichomonads were present in large numbers but in which no bacteria could be cultivated have been reported by Riedmüller (1928 and 1932)—four cases of early abortion; Abelein (1932), one case of endometritis; Witte (1933), four cases of abortion; McNutt, Walsh and Murray (1933), four out of five cases of pyometra in which material was properly taken; Cameron (1935), one case of pyometra; whilst Hopfengärtner's case (Drescher, 1925) was also apparently pure. Cases in which trichomonads but no pathogenic bacterium could be cultivated were reported by Pfenninger (1936), two cases of abortion; and Witte (1934), twelve cases of abortion.

Cases in which no bacteria were visible by microscopic examination, or in which it is stated, without details of method, that no bacteria were present (cultures may have been made), have been reported by Drescher and Hopfengärtner (1933)—41 out of 56 cases of abortion—and Ubertini (1934)—110 out of 112 cases of pyometra properly taken. Bacteria were, moreover, apparently not present in any considerable number in the case of most reporters, since no mention of them is made.

It may at first cause some surprise that there are not more reports of cases in which trichomonads were present without associated bacteria. The main reason is probably that microscopic examination is the simplest way of demonstrating the trichomonads and that cultural examination was not made. The paucity of reports of pure cultures, even from early abortions and pyometras, does not imply necessarily that they are a small proportion, but merely that relatively few complete examinations of properly taken material have been made. It would, of course, be expected that material from the vagina or prepuce or from many cases of endometritis or pyometra would be contaminated with various organisms.

Artificial Transmission of the Disease

Artificial Transmission to Large Animals

With Natural Material.—Though the number of experiments is small, all the characteristic symptoms of trichomonas disease have been produced by one or other worker by the injection of infected material *per vaginam*. Abelein (1929) injected a bull, a heifer calf and a cow with pyometra material. The bull calf showed nothing. The heifer calf showed a vaginitis for some time and at slaughter showed numerous trichomonads. The cow, which was pregnant, showed symptoms of infection and was made to abort; the foetus was found to be infected with trichomonads. Abelein (1932) tried to infect five cows. All showed vaginitis for a short period, trichomonads being detected in one or two. In a further series of experiments on six heifers and one cow, the same worker collected material from a number of cases of pyometra. Filtrates from these samples, together with the various kinds of bacteria that could be isolated from the material including staphylococci, streptococci and coliform bacteria were obtained in pure culture by Ernst at the Schleissheim laboratory. Three control animals were inoculated with this material *per vaginam*, and served. Two conceived; one had a normal calf, the other a dead calf at nine months. The third cow did not conceive. Trichomonads could not be detected in any. The four remaining animals were injected with the original material from which the filtrates and bacteria used for the controls were obtained (presumably mixed). One did not produce a calf, and showed an endometritis from which staphylococci were obtained. Trichomonads were not certainly detectable although bodies suggestive of trichomonads were seen. In the second, infection with trichomonads was established, but conception did not take place until the third service, at which time they had apparently died out. This cow was killed when two months pregnant, and no trichomonads found. The third animal showed a purulent vaginitis for 14 days and chronic trichomonad infection of the uterus for one month with persistent corpus luteum. The fourth animal showed vaginitis and purulent trichomonad secretion, and aborted at 36 days. Chronic metritis and sterility followed.

Kust (1933) infected a proved clean bull artificially by injecting 25 c.c. of pyometra material into the sheath. Swelling, pain, etc., were produced, and numerous trichomonads were found. The bull was used to serve a known clean cow that had previously had three normal calves. Five hours later, the cow was uncomfortable, with vulva swollen, reddened and showing a slight discharge. These symptoms continued for three days, the discharge becoming

more pus-like and showing numerous trichomonads. Pregnancy was diagnosed six weeks later, the vaginal mucous membrane then being swollen and reddened, the cervix abnormal and showing a slimy yellowish discharge, whilst small nodules were present in neighbouring parts of the vagina. These symptoms continued until about the sixteenth week, when abortion occurred. Trichomonads were found in the discharge for a further nine days, and then disappeared. Three weeks later the cow came into oestrum. The bull was examined eleven days after service under sacral anaesthesia. The penis showed very red pin-head nodules, and a small amount of discharge present in the prepuce showed trichomonads. After washing out with saline, this and the nodules soon disappeared. Eight weeks later the bull was used for two cows, both of which remained normal.

Futamura (1935) applied infected material to the vagina (? number of animals) with consequent vaginal discharge from the eighteenth to the sixty-ninth day, but abortion did not follow.

Cameron (1935) tried to infect three heifers. One was injected *per vaginam* with 25 c.c. of infected material. She did not settle till nine months later, after many services, and aborted at four-and-a-half months. The second received 5 c.c. of material from the first heifer *per vaginam*, but apparently without result. An attempt was then made to infect her with fresh material, but she calved normally. A third heifer was tried with a bull known to be infected, but calved normally.

McNutt, Walsh and Murray (1933) produced abortion in one heifer by injection "of the protozoa" into the pregnant uterus. Application *per vaginam* in another heifer was followed by mild vaginitis for two weeks, and abortion at six months. The abortion was not, however, considered due to trichomonads. Vaginitis was produced in several other heifers and a cow, lasting usually for about 30 days. The cow, when killed after two months, still showed severe trichomonas vaginitis.

Emmerson (1932) infected one cow, which became positive on the ninth day and remained positive for 25 days.

Andrew and Rees (1936) reported that, by vaginal application, they produced vaginitis and discharge, which lasted for five months, in five non-pregnant ewes. A ram, which was also exposed, did not become infected.

With Artificial Cultures.—Riedmüller (1933) inoculated a five months pregnant cow *per vaginam* with 8 c.c. of "second passage culture." Abortion followed after 25 days and trichomonads were found in "all" organs of the foetus.

Witte (1934) produced severe vaginitis in three healthy young cows. Two were served several times by a previously healthy bull, but proved sterile. The bull became a carrier. The third took at the fifth service, when free from trichomonads, and calved normally, thus proving the fertility of the bull.

Futamura (1935) reports that the application of a tampon soaked in serum-glucose-broth culture to the vagina caused exudation in six days, which continued for about 60 days, trichomonads being present. He also reports a foetus aborted as a result of infection by a pure culture.

Artificial Transmission to Laboratory Animals

With Natural Material.—Some of the characteristic symptoms of the disease as it occurs in bovines can be produced in guinea-pigs, whilst rabbits and mice have also been infected.

Riedmüller (1929) was the first to infect guinea-pigs. Six animals were infected intraperitoneally, and one subcutaneously, with heavily infected material. Six showed no ill effects. One died after 16 days and showed considerable peritonitis and an exudate (8 to 10 c.c.) containing numerous trichomonads. This exudate was injected into another guinea-pig, and so on, and in three serial experiments five out of six guinea-pigs died: two aborted, one had young prematurely, another aborted at the point of death. Attempts to infect by the intravenous or subcutaneous route, or by feeding, were unsuccessful. Intravaginal injection of two guinea-pigs was followed by some discharge and vaginitis, and trichomonads were present for a few days. Riedmüller (1930) states that, in all, he attempted to infect guinea-pigs with material from 13 cases but that he was successful in only two cases. In over 60 guinea-pigs inoculated from these two cases, he found only about 10 per cent. refractory. Many of these were, of course, inoculated with material which had already been passaged in the earlier guinea-pigs of the series. Peritoneal exudate in guinea-pigs may be whitish, yellowish or reddish, and a fibrinous layer may be present on the lining epithelium. The protozoa were present in enormous numbers, often in pure culture, or, in some cases, contaminated with other organisms derived from the original discharge or from the guinea-pig. Riedmüller (1932) reports further serial inoculations of guinea-pigs to obtain antigen for complement-fixation tests.

Witte (1933) injected four guinea-pigs intraperitoneally with 5, 3, 2 and 1 c.c. respectively of pyometra pus. Only the one which had received 5 c.c. showed symptoms; it aborted and trichomonads were found in the uterus but not in the foetuses. In a further experiment, five guinea-pigs were inoculated *per vaginam* with 2 c.c. of uterine material. One aborted showing numerous trichomonads. A second had two young both of which died from trichomonas infection a month or two later.

Walsh, McNutt and Murray (1934) reported that they had inoculated a large number of guinea-pigs by the intraperitoneal route, but that, although 12 per cent. died and six out of 13 guinea-pigs aborted, they had found trichomonads in none of these.

Futamura (1935) reported the inoculation of seven pregnant guinea-pigs intraperitoneally. Six aborted, one to 20 days later, and vaginal examination showed trichomonads. This worker found the mouse more susceptible than the guinea-pig; fatal results occurred or the trichomonads remained in the uterus for six months.

With Cultures on Artificial Media.—Witte (1933) made a large number of experiments on the infection of rabbits and guinea-pigs with pure cultures. He found that four out of five rabbits injected *per vaginam* between two services at intervals of six hours showed persistence of trichomonads for one to four weeks. Abortion did not occur. Three out of five inoculated animals and one out of three controls remained sterile. No trichomonads were found in the controls.

Pregnant guinea-pigs inoculated intraperitoneally frequently aborted, and usually died afterwards, showing a purulent peritonitis. Trichomonads were present in the uterus, peritoneum, pleural and pericardial cavities. Of five guinea-pigs which received 5 c.c. of a strain that had been subcultured 33 times on artificial media, two aborted and died, whilst a third showed persistent uterine infection. Three other guinea-pigs received 5 c.c. intraperitoneally of

blood-broth-culture of a mixture of five strains. Two aborted and trichomonads were present in the uterus and peritoneum of both and in the foetus of one. In the third case the young were born normally but the uterus contained numerous trichomonads. In a further attempt to find the possible portals of infection, the same mixture of blood, broth and culture was used to inoculate guinea-pigs by the intramuscular, subcutaneous, intraperitoneal, vaginal, intracardial, conjunctival, and oral routes respectively, three pregnant guinea-pigs being generally used for each group. All animals of each group received 5 c.c. of culture, except in the case of the intracardial route when 2·5 c.c. was used, the vaginal when 2 c.c. was used, and the conjunctival when a few drops were used. Two out of three guinea-pigs inoculated intraperitoneally aborted, and one out of three inoculated *per vaginam* developed persistent uterine infection. One animal inoculated subcutaneously and one inoculated intramuscularly died from trichomonad infection. The remainder presumably showed no symptoms.

The Pathogenicity of *T. foetus* by Intracerebral Inoculation

Lwoff and Nicolau (1935) showed the curious fact that when a pure culture of *T. foetus* is inoculated subdurally it gives rise to an encephalomyelitis, usually fatal, in the rabbit, guinea-pig, rat, mouse, dog and monkey. Nicolau and Lwoff (1935) give details of the symptoms, macroscopic appearances and histology (24 figs.). They find that the parasite has a predilection for the ventricles and a tendency to destroy the cerebral matter. Giant cells are common.

Immunity

Little is known regarding possible immunity, although Andrews, Millar and Rees (1935) in a brief note have recorded some interesting observations. In common with some other observers they regard the disease as self-limiting and bring forward some suggestive evidence that spontaneously recovered animals are refractory to reinfection. The duration of this refractory state if present and whether it is a sterile immunity (*i.e.*, non-infective) or of the nature of premunition due to the persistence of a mild infection is not known.

Discussion, with Particular Reference to Aetiology

Evidence has been presented from various sources that there has existed for many years a condition characterised by difficulties in breeding, early abortion (usually before half-time), endometritis, pyometra, and, in many cases, vaginitis, which is transmitted by coitus, spreads rapidly and shows all the characters of a contagious disease. Further, that the condition is associated with the presence of trichomonads (*Trichomonas foetus*) which have similar characters in all outbreaks and in all the clinical manifestations of the disease and which have been generally accepted as the cause.

Trichomonads in large numbers have nearly always been found in the more obvious forms of the disease, *e.g.*, early abortion and pyometra, and have also been demonstrated in the other forms. That they are not regularly demonstrated in the more chronic forms may be ascribed to the now well-known fact that they are often present in small numbers, may be present one day and absent the next, and that, until quite recently, no cultural method used has proved capable of regularly detecting their presence when in such small numbers that they are not also demonstrable by direct microscopical examination, whilst serological examination has not proved of any considerable help in diagnosis.

With the exception of the report just published by Kust (1936), *T. foetus* has not been found in normal animals, *i.e.*, unexposed animals, on affected farms, or on farms on which the disease does not exist and only rarely in normal organs, most workers having failed to find it at all. Moreover, it is not present in cases of endometritis, abortion, pyometra, vaginitis, etc., which are ascribable to some other cause, *e.g.*, *post-partum* endometritis or pyometra, contagious vesicular vaginitis, abortion due to *Br. abortus*. Bacteria do, it is true, frequently accompany the trichomonads, and are thought by some workers to be of significance, while the presence of a filterable virus, known or unknown, has also had to be considered. The bacteria present, however, have varied from case to case, and are not of pathogenic type, and Abelein (1932) showed that whilst it was possible to transmit the disease with material containing trichomonads, it was not possible with a mixture of filtrates and cultures of all the bacteria that could be isolated from the same material. Further, in many cases in which it has been possible to obtain material in a suitable manner, cultural examination has shown that no bacteria of any kind were present, or, in a larger number of cases, that pathogenic bacteria were certainly absent. In a very much larger number of cases it has been reported that, whilst trichomonads were present in large numbers, no bacteria could be seen microscopically, or else the statement has been made that bacteria were absent, without an indication whether this statement is based on microscopic or cultural examination. Many of the outbreaks have occurred in herds free from the ordinary *Brucella abortus* infection. In material from the vagina or bull's sheath and also in many cases of endometritis or pyometra, it would, of course, be expected that various contaminants would be present.

Transmission experiments have added considerable support to the view that *T. foetus* is the cause. All the clinical forms of the disease have been set up in the bovine by the artificial inoculation of infected material (which showed no other pathogens) *per vaginam*, whilst typical vaginitis, and in one case typical abortion, has been produced by cultures of *T. foetus* in artificial media. The evidence is admittedly insufficient in so far as bovines are concerned.

It is supported, however, by considerable evidence obtained by a study of the infection of guinea-pigs. Infection and abortion has been produced not only by carrying the infection from guinea-pig to guinea-pig by intraperitoneal inoculation but also by inoculation *per vaginam*, the natural method in outbreaks amongst cattle. Further, this infection can be produced by inoculation, by either route, of trichomonads which have been cultivated artificially for many generations; in the case of Witte's experiments, for 33 generations, implying a dilution of the original material at which no virus could remain in sufficient quantity to be active, quite apart from the duration of incubation. The suggestion that the virus believed to be responsible for contagious vesicular vaginitis is the cause or a contributory cause (Reisinger, 1928, and others), is controverted by Witte (1933), who concluded that there was neither experimental nor epidemiological evidence to support this contention.

Despite the absence of adequate data from infection of cattle with artificial cultures, there is, therefore, considerable evidence to support the belief that the trichomonad known as *Trichomonas foetus* is the cause of the disease. The finding of Kust (1936) that trichomonads (indistinguishable from *Trichomonas foetus*) can be cultivated from the blood of affected or suspect cattle, and also in several cases from unserved cattle, *i.e.*, from animals which cannot have become infected by the usual route, the bull, raises, however, anew the question whether *Trichomonas foetus* is, as has been generally believed, a pure parasite and the disease a purely venereal one. Moreover, if further work should show that trichomonads, proved to be *T. foetus*, are present in the blood of any considerable number of normal animals in healthy herds, doubt will be raised as to whether *T. foetus* is wholly responsible for the disease concerned or whether, as some observers have believed, there is some other factor, *e.g.*, a pre-existing catarrh, which enables the trichomonads to multiply freely in the genitalia. Also, another possible source of the disease will offer itself. It may be recalled that Braune (1913), cited by Wenyon, described a trichomonad of the rumen of cattle to which he gave the name *Trichomonas ruminantium*. Little is apparently known regarding the frequency or physiological characters of this organism, but it has generally been regarded as distinct from *Trichomonas foetus* on account of its location and morphology. Dobell (1934), however, has given reasons, based on transmission experiments and other considerations, for concluding that the vaginal and intestinal trichomonads of the human being (and also of macacus monkeys) are strains of one and the same species. Dobell's conclusion cannot be transplanted to apply to the trichomonads of cattle. It does, however, raise the possibility that the trichomonad of the genitalia of the bovine may be the same as that of the rumen, acclimatised to a new environment. If this is the case, trichomonas disease might occasionally arise in a spontaneous manner.

This would, however, in no way alter the well-founded view that normally it is a disease of the genitalia spread by coitus and that methods of controlling outbreaks must be mainly directed to prevent its spread in this way.

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Present-Day Horse Practice*

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This year the Division celebrates the sixtieth anniversary of its formation. Any society that has arrived at that mature age must have exerted, and still should exert, an important influence upon its own members in particular and the veterinary profession in general. I am a Midlander by birth, but when I look back and find that for 38 years, practically the whole of my veterinary life with the exception of the years I spent in London, I have lived in, or on the borders of, the Eastern Counties, I feel that I may claim to be almost a native.

In other places we hear of the President playing himself in, and sometimes he foozles his tee shot, but here he has to talk himself in, a much more difficult and dangerous task. He may, by being possessed of a naturally retiring disposition, wish he had not to do it; on the other hand, he may be quite pleased to undertake the task of addressing his hearers on some current topic of importance. He may even seize the opportunity to let off a lot of steam, the production of somewhat vague notions that have for long been simmering in his mind. Since it is customary, however, for it to be done I have, in order to lessen the chance of foozling my drive off, chosen for my theme a subject about which, from years of environment, experience and inclination, I ought to have some intimate knowledge, and it is a subject which has become a very special problem for the veterinarian, namely, The Horse. I feel sure, too, that in these agricultural counties which in the past produced, to mention only a few, such stalwart veterinarians as Spooner, Simmonds, Shave and Shipley, this subject even in these days is not without interest to most of my listeners.

In reviewing the present field of endeavour of the veterinary surgeon in relation to horse population one cannot ignore the great tendency there is to-day for the horse to be ousted by the machine. (The rate of evolution of the internal combustion engine compared with that of the horse has placed the latter at a great disadvantage.) Even in the sphere of agriculture, the home of the horse, steady replacement goes on—more slowly in some parts of the country perhaps than in others. Tractors on the land and for haulage are gradually increasing. The sole consideration of motors in regard to road construction is practically forced by necessity upon the authorities concerned, and the result is such, along with the present-day rush for the saving of time, that farm road transport is now largely done by motor lorries. It is not, however, without great significance to the veterinary surgeon that the returns for 1935 for England and Wales show that approximately 586,000 horses were used solely for agricultural purposes, a fall of some 10,300

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[To be continued by a description of the outbreak in this country and laboratory data appertaining thereto.]

from the previous year; but of unbroken horses and stallions there was a counter-balancing increase of 11,500, the number under this classification being 143,000, so giving a total of 729,000 agricultural horses. There were 144,000 other horses, and if these and the horse population of Scotland, 147,000, be added, this would give a total of 1,020,000 head for Great Britain.

Then again, in regard to veterinary needs in the Army we know that mechanisation has been very extensive and is certain to be carried much further, although one can hardly visualise that the day will ever come when the horse and mule will disappear from this arm of the Services. It would seem that whereas these animals might not be necessary in peace time there must always be certain work on active service for which only they can be employed; and since the various organisations necessary for their employment on active service and the training of men in the use and care of them could not be neglected in peace time, it follows that there must still be a considerable number of these animals on the Army establishments. And we hear much nowadays of expansion and serious preparation for war. The number of horses and mules on the strength of the Army in 1935 was 14,474, a fall of 1,820 on that of the previous year; roughly, this is a 9·44 per cent. greater fall than in agricultural horses. If we now turn to the large towns we find that the falling off in the number of horses used is at an even higher rate. Unfortunately any advantage there may be in the use of horses in this sphere, either on the grounds of economy or convenience, has lost its significance for deciding between them and motors, for their banishment is threatened, if not already decided upon in certain areas. That their use is one of the chief causes of the terrible congestion of traffic is given as the reason for the necessity of this action. Much as one deplores this decision, one is forced, if one speaks quite unbiasedly and purely from personal experience of driving through some of the large towns, to think that the drivers of the horse traffic have themselves been very largely responsible. They seem to have thought that because they existed before motors they had the prior right; one sees the same thing in the action of cyclists. How often one has to crawl behind a slow-moving horse-drawn vehicle because the driver will not pull in towards the left kerb, possibly because he sees another vehicle pulled up dozens of yards ahead, but many times even when he has a clear road in front of him. The decrease in number has been, and is likely still to be, much greater in the heavy rather than in the light type of animal; the latter being employed by the smaller tradesman who cannot afford the original outlay upon, or the running cost of, a motor vehicle. Similarly, too, this class of owner is unable to be a very profitable one to the veterinary surgeon. The decreased demand for heavy horses is sure to be reflected back to the place of their production, no matter how strong is the argument that supply creates demand.

Against the tendency to decrease in the number of horses employed in these various spheres we may now turn to other spheres where the outlook is more encouraging. It is quite possible that the enquiries into recent colliery disasters may lead to a curtailment of the use of electricity in mines: an increase in the number of horses used in mines would follow. The total number so employed in Great Britain in 1935 was 35,505, a decrease of 2,245 from the previous year: a 6·32 per cent. decrease, a rate which had remained level during the previous four years.

Lastly, if we consider the various spheres of use of horses which we may group under one heading, "Pleasure"—hacking, hunting and racing—the outlook in each must be promising. Without being able to quote exact figures as a guide one cannot help noticing the greater interest taken in riding, and the formation of riding clubs aiding and encouraging this interest. Some of us belonging to what has recently been referred to as the "horse-age," although we may feel some surprise at many who become interested in this direction, must experience considerable pleasure that they do so, and not only from a monetary point of view, for love of a horse still is a great bond of friendship in the British character. I have been told by some of these new enthusiasts who live in the large towns that going down into the country and having an afternoon with the riding club is not only the most beneficial and enjoyable form of recreation, but also one of the cheapest. Many who start in this way will later on, when they may be able to afford the greater expense, graduate in the hunting field. Pony clubs, too, must not only stimulate interest in riding but by instilling necessary and useful knowledge into the minds of their young members create a healthy and increasing supply of the next generation of followers of hounds. Hunting itself has probably never been more popular or better supported, and this general increased interest in riding is likely to keep it so. Finally we come to racing: no one can doubt the present genuinely healthy condition of this sport, and sport it now more purely is. It was argued that one of the chief objects of racing was to indicate by actual tests on the course the best lines in which breeding should proceed in order that its ultimate object should be obtained, namely, the production of animals capable of great endurance and speedy movement for use in war. This may have been a very real object at the commencement of the

thoroughbred's evolution, for it was what those campaigning in the East had seen of the capabilities and endurance of the native horses that suggested the possible great improvement that would follow crossing them with our own stock. This took place about the year 1687. One doubts, however, whether this primary object was entitled long to be classed as the chief one; and mechanisation of the Army has now laid it low for ever. To breed animals capable of galloping over varying distances of ground in less time than those against which they are competing has been, and probably always will be, almost the sole object. Very fortunately for the general well-being of the sport there are many who breed racehorses and follow racing still actuated solely by the highest motives, namely, to improve the breed and to race for the love of the sport. By far the greater number of those interested, however, are in it for commercial reasons, and this as the primary reason, extends from some breeders and buyers through the racecourse companies that provide the racing to the vast company that attend the meetings, and to the still larger number who closely follow racing in their own homes away from the course. Finally, the services of the entire thoroughbred of recognised good breeding and of proved racing ability may command such fees when retired to stud that it becomes a very sound commercial proposition; so sound that most owners even if they have not already a stud of their own at which to stand the horse will take or create one, or while still retaining possession of the animal will make arrangements for it to stand at an already existing stud. Should such an animal come into the market the competition to obtain it is sometimes so great that a very high price is obtained. Very rarely the buying of such an animal is followed by disastrous results: £60,000 was the sum paid a few years ago for a horse that has been almost a complete failure.

Exact figures for the various classes of bloodstock in the country at the present time are not available. Approximately there are 5,670 horses of both sexes in training, and of 7,199 mares named in the Stud Book Supplement for 1935 some 6,270 were returned as having been mated with thoroughbred horses, only 60·66 per cent. of which had living foals. Yearlings, horses not in training and stallions might probably number about another 5,000.

I know of no means by which one could arrive, even approximately, at the economic value of these animals. It is safe to say, however, that even if one took it at the figure at which it would be assessed for probate purposes the total would be colossal. When we hear, as we have done during the last week, of an individual being sold for an amount between £45,000 and £50,000 and of 364 yearlings sold at Doncaster last September for £273,620, one is left wondering what that total might be.

There are many factors that exert a marked effect upon values. The market is very sensitive, and the Italo-Abyssinian dispute, although it did not appear likely at that time that there would be any extension of it to other countries, did undoubtedly affect values at last year's Doncaster Sales. The general prosperity of this country probably has the most sustained effect, but the prosperity of other countries also has a very marked influence. It is rightly claimed that the British Isles produce the best thoroughbreds and that other countries have continually to come here to replenish their stock in order to keep it up to anything like standard, just as they have to do in practically all other breeds of animals. If economic or other conditions prevailing in foreign countries or our colonies are such as to impede or prevent this, oversea trade values are affected. At the present time there is practically no foreign trade. Trade with America both North and South, France, Germany, Italy and Australia, the biggest buyers in normal times, is practically non-existent. This may be in part responsible for the slight increase in numbers which has been taking place in late years, but in spite of the increase there still is considered to be a definite shortage and this is tending to raise values generally. Should world conditions improve and foreign trade in bloodstock be opened up, many who are in a position to express an opinion and who do not express opinions lightly, assert that there must be a very great shortage and that prices will soar. Any marked rise in values, although it may be good for those people personally interested in bloodstock, is not an unmixed blessing for the breed itself as judged by what happened in those years shortly after the War, when values were at their highest. To own a thoroughbred mare was thought to be a short way to the making of a fortune. As prices advanced practically every filly was eventually bred from, no matter how poor its racing ability, how unfashionably bred or how faulty its conformation. The general use of taxis and the falling off of oversea trade may partly have helped to push some of these misfits through what in former days was a needle-eye entrance into stud life. Then a mare had to be of proved racing ability, well or even fashionably bred, and of good, sound conformation for it to be selected for breeding. Some of the more important breeders may have been the worst offenders in that they held nominations to the best stallions and mated with them mares received back from the training stables, where they had been found sadly wanting. I feel sure we see the results of this in the nondescript, bad-legged animals walking round

the sale rings. Fortunately a very large number of such animals were thrown out of studs when there was a great fall in prices a few years ago owing to the world economic crisis. It is cordially to be hoped that any possible marked rise in prices will not again be followed by such a short-sighted policy. This holding—I am almost tempted to say cornering, for they are booked up years ahead—of nominations to the best horses by wealthy owners often precludes the possibility of a better mare, the property of a small owner, being mated with one of the best stallions. It is difficult to see how this can be avoided, and after all it is highly probable that the present system which has gradually been evolved alongside the development of the thoroughbred is the most satisfactory, for the really good mares sooner or later find themselves the property of the wealthy owner.

By stating that the majority are commercially interested in racing and so in the thoroughbred, I do not for a minute wish to infer that this is in any way a harmful interest. It reacts all for the good, namely, to stimulate the production of better and still better animals. Nor when I say that these commercial reasons extend to those attending the various race meetings and to those who follow racing away from the course, do I wish to infer that this is a harmful interest. Certain it is that individual harm may result in some cases, but judged by the standard of the greatest good for the greatest number, here again this commercial interest reacts all for good. In the past perhaps more than at present there has been a tendency for those people whose concern it is to look after the country's welfare to decry sport and gambling, but the studies of psychologists are fast providing evidence that the evils are far outweighed by effects upon the mind which make for contentment and happiness in a population.

In spite of the increasing banishment of the horse by motors from the daily lives of the population, and in spite of strong counter attractions such as football, cricket, dog racing, etc., interest in horse racing is as keen as ever, attendances at meetings tend to increase; and a rising standard of living is not solely responsible for this, for psychologists also tell us that some form of stimulation or excitement of the senses is even more necessary in times of stress and hardship, if some degree of contentment and control is to be maintained.

It is quite impossible and unnecessary within the scope of an address of this description to enter into all the problems to be dealt with in racehorse veterinary practice; suffice it to say that the problems the practitioner is likely to be concerned with are all those met with in every-day horse practice. Many of them, perhaps, if I may so put it, in an intensive form, partly because of enhanced values and partly because the more active part of a thoroughbred's life is of a forced character; and there are some problems which, while being of almost every-day occurrence in bloodstock practice, are rarely met with in ordinary practice.

In order to review briefly some of the particular and more important problems it may be convenient to split them into two main groups: Those met with during the stud life, and those during the racing career of the thoroughbred.

For the former, a more intimate knowledge of all aspects of breeding is necessary; and this not confined to the animal itself but to its whole environment in the widest sense of the term, including even the selection and the laying out of a stud. A very sensitive appreciation of any deviation from the normal in regard to the genital organs and the whole reproductive mechanism, more particularly of the mare, is essential, for in this direction probably lie the most important and pressing problems of all. It is estimated that between 30 and 40 per cent. of mares mated in any one season have no living foal. This is also probably true of the coarser breeds, but when we consider the very much larger outlays concerned in regard to bloodstock, capital outlay, high stud fees, travelling expenses and cost of maintenance, one can appreciate the proportionately increased importance these problems assume. The barren mare one might almost class as a nightmare! To arrive at the true cause of its barrenness and later to treat so as successfully to return it to a profitable stud life will tax to the full human knowledge and skill, and in many instances beyond their limit.

The actual mating of these animals is a problem that has sometimes to be undertaken. Many thoroughbred stallions have some one or other peculiarity, and to get one to serve its first mare may tax all one's resources and most of one's patience. Reference may also be made to insemination as an important duty met with in stud work. It is frequently adopted and it is highly probable that it will be even more so in the future.

Parturition, its attendant difficulties, ills and worries, will make severe calls upon the practitioner's energy and ability just as it does in other forms of horse practice. And here again, although a life is only a life, increased values, no matter how hardened and confident one may have become, cannot but exert some psychological effect upon one's mind. That a mare probably has a market value of thousands of pounds, that a foal has cost four or five hundred pounds to get and may have a potential value of several thousands does not add to one's

peace of mind when at the end of one's resources to save its life. It would probably be correct to observe, however, that there is some consolation in knowing that owing to the greater general care expended on thoroughbreds, the better and more careful feeding of them, and the much better general surroundings in which they live, these difficulties and worries are proportionately less in regard to the number of animals under one's care than is the case with the coarser bred animals; increased values work in one's favour in this respect.

Then, too, in regard to bloodstock, the veterinary surgeon's advice is perhaps now more frequently sought, and with benefit, we hope, in regard to the care and management of young stock, apart from disease, from the time of its birth up to weaning and again from this time until it is broken as a yearling and goes into training.

Passing to the period of the horse's racing career, problems common to all types of horse practice arise, but here again it may be remarked that the great care bestowed upon the thoroughbred, regular feeding on picked food and regular exercise and grooming, considerably lessen the occurrence of many of the ills, and even banish some, met with in other types of practice. Accidents occurring to tendons, ligaments and bones as a result of the severe strain put upon them during fast work on ground of varying degrees of firmness are problems of great moment. A special knowledge of the principles of shoeing and the care of the horse's foot is of particular importance, for there are many fads and fancies held and practised in this direction which can only be combated by sound practical knowledge and experience. The pace at which these animals work, the frequent removal of shoes and plating for racing necessitates expert workmanship on the part of the blacksmith responsible, even in animals of the best conformation and truest action, but when bad conformation and faulty action exist he needs to be an artist. There are experts and even artists in their calling, but they are the exception. The veterinary surgeon, therefore, should be capable of giving the necessary advice.

One more subject that I must touch upon, but can only name, for it would form a lengthy discourse in itself, is dentistry—a subject of supreme importance in the thoroughbred, since the greater part of its life in the racing stable is during that time when the various temporary teeth are being replaced and other permanent teeth are being erupted. Indifferent nutrition resulting from want of attention to the teeth during this period would be fatal to the horse's well-being and consequent racing ability. There is undoubtedly a real necessity for the application of similar attention and care to horses of other breeds and in other spheres of work; many cases of chronic nasal catarrh and periodontal disease would be prevented.

From what has been said of numbers, values and interests it is evident that there is, and there still is likely to be, some real scope for the veterinary surgeon who has a liking or special aptitude for horse practice, and especially perhaps for that more particularly concerned with the thoroughbred. It may not be out of place, therefore, briefly to consider some matters relevant to the training of graduates to fit them for this class of work. In doing this one necessarily has to pass on to more general and also more controversial topics. They are, however, equally important to us all.

It had been a general complaint, rightly or wrongly, that the newly-qualified veterinary surgeon was ill-fitted to the needs of country practice. To correct this the Royal College of Veterinary Surgeons thought fit to introduce a revised and extended curriculum for the more thorough training of the student. It is open to doubt, however, whether the new curriculum, even with the included compulsory practical experience, will succeed in overcoming this deficiency of which complaint has been made. It is highly probable that one has to look further back for the root cause of the trouble; and if this be done the following query would seem to suggest itself as being one of primary importance: Is the best type of student encouraged to enter the profession; is the same source that formerly produced the supply being tapped, or have any difficulties, or even slight obstructions, within or without the profession, occurred to change its course? Can it be that the likelihood of a great increase in the number of whole-time appointments has attracted the majority of students from a class devoid of any fundamental knowledge or experience of, or any particular liking for, animals; has, in fact, a large proportion of them been attracted chiefly by the possibility of fixed hours and remuneration?

It would seem that this lack of knowledge and special liking for animals is accompanied by a lack of the old enthusiasms and will to work hard in regard to the problems affecting them, and a total lack of appreciation of the uncontrolled hours that have to be observed in connection with animals, no matter in what course that connection is going to be pursued. Yet the holding of this knowledge and appreciation of animals and their natural surroundings, and the enthusiasm for tackling the problems affecting them, is just as important in the student that may eventually follow the path of purely scientific investigation or research as in the one who elects to go into general practice. Scientific research into animal problems,

physiological as well as pathological, has certainly suffered, and still does suffer, as a result of being in the hands of those who may be totally lacking in this personal acquaintance with animal environment, and many of whom have not even any veterinary qualification. No imagination or high scientific attainment can possibly replace, or even counter-balance, the lack of this knowledge or appreciation. While on this subject one might remark that it would seem to be eminently desirable that a greater number of the chief posts concerned with the investigation into animal problems should be held by men with veterinary qualifications. One might go so far as to say that all should be so held; and further, that there should be a closer co-operation with the practitioner in the field. Many of the latter are in the best position to give advice as to the problems that require investigation, and even some advice in the manner how best this can successfully be carried out. The practitioner may not know or be able to recognise the bricks or material of which the whole structure of a particular disease is composed but he has a much greater knowledge and appreciation of the complete edifice as he comes in contact with it in the field than the scientific investigator working on the units in the laboratory.

Returning to the training of students so as best to equip them for horse practice, one necessarily has to review the existing curriculum. By considering it in detail anyone who studied under the old grouping of the subjects might find much material on which to argue at great length; but to deal with it very briefly one might question whether the student in his first year is sufficiently occupied by subjects in which he *must* sit an examination, as to make him appreciate the necessity for serious work—a great necessity as a sound jump-off if students are to be so influenced thoroughout their whole college career. Then in the second year, did not we already qualified veterinary surgeons have a great advantage over the present-day student in being taught Physiology and Histology alongside Anatomy? Is the present student helped in acquiring his knowledge of physiological action and histological detail by being entirely ignorant of even gross anatomical structure? A little more comparative or veterinary physiology might perhaps usefully replace some of the higher standard Physiology and Histology. Similarly, in the third year, most of the detailed knowledge to be acquired in order to pass the respective examinations in Pharmacology, Hygiene, Dietetics and Animal Husbandry must of necessity be learnt parrot-fashion in the absence of any knowledge of general Pathology and more specific diseased conditions. Finally, one is unable to observe that much greater time will be allowed to students for the study of Medicine and Surgery than under the old four years' course.

These shortcomings, if one may be so bold as so to designate them, would appear to assume an even greater significance in view of what has been said in regard to the more commonly uninitiated source from which the majority of students are now drawn.

Viewing the curriculum as a whole, one wonders whether the best possible use, as judged by desired results, is being made of the increased length of the course; whether the extra time was necessary for the more thorough teaching of the already existing subjects; or whether the additional year could not have more profitably been occupied in an intensive training of students according to the sphere of veterinary work the majority of them would by that period of their collegiate course have decided upon for their future. And might not an early slight differentiation in their training have even already been begun in the previous year?

It would appear that there are three main spheres into which veterinary work may be grouped: (*a*) General Practice; (*b*) Research; (*c*) State Services.

The subjects for intensive training for these groups would be, respectively: (*a*) Clinical Medicine and Surgery; (*b*) Pathology, Bacteriology, Epizootiology and Parasitology; (*c*) Hygiene, Nutrition, Milk and Meat Inspection, and Veterinary Public Health.

Finally, reference must be made to the necessity for further research into some outstanding problems if the teaching of the student is to be up to the highest standard, and, at the same time, that the already qualified general practitioner may be equipped with the necessary knowledge in order the more efficiently to carry out his multifarious every-day duties.

Before mentioning some such subjects that may readily suggest themselves one must acknowledge the great help and benefit that has already been obtained from past research. Work that has enabled some diseases to be stamped out and others to be controlled. To mention a few: Glanders, rabies, poll-evil and fistulous withers, contagious equine abortion and joint-evil. Then in regard to present research one is glad of the opportunity to acknowledge the great assistance that is already being obtained, particularly in the thoroughbred world, from the most important researches of Professor Miller into pregnancy diagnosis. And it is particularly gratifying to realise that there are among the younger members of the profession some who are not prepared to accept without question the findings of their predecessors in regard to various diseased conditions affecting horses. It may well be, in the light of present-day knowledge, that

some of these findings were arrived at by as faulty lines of reasoning as have been ascribed by enthusiastic supporters of these ideas to the present-day worker. Reference, of course, is made to Professor Mitchell's researches into various skeletal disorders of horses which have commonly been accepted as hereditary.

Some subjects requiring further research are:—

Respiratory Diseases.

Parasitology: Chiefly in so far as it concerns the more common worm infestations of the larger domestic animals in this country.

Dietetics / Genetics { And inseparably bound up with each of these, Sterility of Horses and Ruminants.

It is pleasing to note that some research into these problems in regard to the horse is being undertaken. It is much overdue. Although it has now been instituted chiefly as the result of money being forthcoming from the Betting Control Board, which very naturally has considered that as this is produced by the horse it shall be spent primarily to the benefit of that animal, it is equally certain that funds to finance it would have been forthcoming had necessary and vigorous representation for the pressing need for it been made in the right quarter.

It is fitting and right that well-deserved tribute of praise and thanks should here be paid to one who has by his keen foresight been primarily responsible for the institution of this research, Lord Hamilton of Dalzell, a member of the Betting Control Board. When legislation in regard to the introduction of the totalisator was completed the purposes for which the "rake-off" might be expended did not include Veterinary Research. Lord Hamilton realised this, and when at a later date legislation in regard to lotteries came before the Houses of Parliament for consideration he seized the opportunity to introduce, and was successful in getting carried, an amendment making good this omission. We therefore owe a great debt to him personally for so carefully looking after the interests of one of our chief patients in particular and the needs of the veterinary profession in general.

In making an attempt to indicate, very indefinitely and unconvincingly, possibly, how the student might perhaps be helped towards being better equipped to undertake a particular branch of veterinary work, one cannot conclude without expressing the earnest desire to see this same principle carried still further, namely, to post-graduate life. There is, without doubt, an increasing necessity for specialisation in the various phases of any particular branch of veterinary work. Speaking in regard to general practice, those who have developed or have had thrust upon them consulting practice, must, if they be honest, admit how incomplete and inexact their knowledge is in order to be able to give the best possible assistance to the confrères they are called upon to help. They may in quick succession be called upon to advise in the capacity of a physician, a nerve specialist, a surgeon, a gynæcologist or a dentist, and these severally not only in regard to one species of the animal kingdom, as is the case with our brethren of the medical profession, but in regard to any one of the domestic animals. It is mentally and physically impossible to be expert in all directions. All must welcome the day when a call can be made upon the specialist, confidently knowing that the necessary knowledge and help will be forthcoming. One can rest assured that the calls will be made as willingly and ungrudgingly as the help will be given.

GRASS SICKNESS RESEARCH

At a meeting of Glasgow and West of Scotland Agricultural Discussion Society in Glasgow, Dr. W. S. Gordon, senior bacteriologist to the Animal Diseases Research Association, reviewed the present position with regard to the investigation of grass sickness in horses.

He said that the Animal Diseases Research Association had been faced with a wealth of negative evidence and it was difficult to select a line of inquiry which might yield encouraging results. He had been able to report at the Annual Congress of the National Veterinary Medical Association in 1934, that a toxin formed by an organism belonging to the group known as *Clostridium welchii* had been found in six out of about 40 cases of grass sickness examined. The organism responsible for producing this poison in the bowel had also been isolated from a few infected horses, and, whilst it had to be emphasised that the positive evidence was very meagre, two additional years of continuous work along this avenue of investigation had brought no evidence to suggest that this line of inquiry should be abandoned. In fact recent work suggested that it might profitably be pursued with even greater intensity, so that the present theory that this toxin was involved in the causation of grass sickness might either be relegated to the mass of negative evidence or established on a more positive basis than that which now existed.

With this end in view, the Animal Diseases Research Association were at present carrying out an extensive programme of research into the nature and characters of the organisms belonging to the *Clostridium welchii* group. They also intended, in collaboration with the veterinary surgeons in a limited area where the disease was prevalent, to arrange a field experiment in which 1,000 or more horses would be vaccinated against that type of *Clostridium welchii* which had been isolated from some cases of grass sickness, whilst a similar number of horses on the same farms would be left untreated.

Professor Thomas Dalling, M.R.C.V.S.

Thomas Dalling, after a varied experience in many branches of veterinary science and practice, has at the age of 44 been elected into the Professorship of Animal Pathology at Cambridge. To the profession, which has watched with interest, pleasure and gratitude the many advances in the realms of veterinary pathology, bacteriology and immunology which Dalling has continued to make despite a busy life as superintendent of a department largely devoted to routine, the details of his life are unfamiliar. Even upon those occasions when the profession endeavoured to do him honour, as did the "National" in awarding him the Dalrymple - Champneys Cup and Medal in 1935 and the Central Veterinary Society which selected him for the award of the "Victory" Medal in 1936, little biographical material was available to allow the profession to appreciate more fully the background upon which this quiet, unassuming individual had built up his claims to fame.

Born on April 23rd, 1892, Thomas Dalling received his early education at Burdiehouse Public School, of which he was Dux in 1903. He proceeded to the George Herriot School, Edinburgh, where he was awarded a scholarship for three years. He intended at first to be a teacher and was so trained under the Edinburgh Education Authority, but he changed his mind and entered, in 1910, the Royal (Dick) Veterinary College, where after a brilliant career during which he gained silver medals in practically all subjects and certain special medals such as the Leighton Silver Medal for Pathology, and the McFarlane Silver Medal, he qualified M.R.C.V.S. in 1914 with second-class honours. He was awarded the FitzWygram Prize for the best aggregate of marks in all the professional examinations and the Williams Memorial Prize for the highest total in medicine and surgery. Following his graduation, Dalling went into veterinary practice in the Midlands, where he also had charge of a large number of military horses. In 1916 he joined the R.A.V.C., went to France, where he had charge of several laboratories, and was mentioned in the despatches of Sir Douglas Haig. He returned to England in 1919 and entered practice once more. A year later he joined the late Professor Gaiger at the Glasgow Veterinary College, and on the formation of the Animal Diseases Research Association he became a "Chief Investigator." In 1923 he joined the staff of the Wellcome Physiological Research Laboratories as veterinary superintendent, where he has had charge of the large number of horses and other animals used in the preparation of sera, antitoxins and other therapeutic products of this laboratory. It is this laboratory which he will leave soon to take up his new duties at Cambridge.

In spite of his busy life professionally, Dalling has found time to help the N.V.M.A. and its constituent bodies in their many efforts to improve the welfare of the profession. He has served on many committees of the N.V.M.A. and has been Hon. Secretary of the South-Eastern Veterinary Association for many years. He has been Hon. Secretary of the Section of Comparative Medicine of the Royal Society of Medicine and is at present one of its Vice-Presidents. He is an original member and a Past-President of the Veterinary Research Club and was the first veterinary surgeon to be elected a member of the Medical Research Club. He is a member of

the committees of the Agricultural Research Council dealing with sheep diseases and poultry diseases, being Secretary of the latter. In other ways, particularly by his many papers read at Divisional meetings, national and international Congresses, he has helped to increase the prestige of the veterinary profession.

But Dalling's main claim to fame is the character and standard of the scientific investigations he has carried out. He began this work in France when he investigated such conditions as ulcerative cellulitis, specific ophthalmia, catarrhal fevers, etc. When in Scotland he worked on sheep diseases, particularly lamb dysentery and braxy. With Gaiger he isolated the causal organism of lamb dysentery and later showed it to belong to the *Cl. welchii* group. He elaborated the method of protecting lambs against this disease by the vaccination of mother ewes. Concurrently he examined the transmission of maternal immunity in sheep and other animals. He has done much work upon immunological problems. He showed that anti-serum injected into young lambs prevented lamb dysentery and as a result of this work and that upon the development of the best type of vaccine for the ewe, vaccination of ewes and the injection of lambs with serum is now practised all over Britain as a prophylactic against lamb dysentery. Field work constituted a large part of the activities in the lamb dysentery researches, and here Dalling excelled. Since these studies Dalling has continued to work upon the organisms of the *Cl. welchii* group and he, with other workers, has added much to our knowledge of these organisms and their toxins.

Dalling has also worked upon dogs and has shown that the form of jaundice in this animal known as "yellows" is due to leptospira. He showed that the use of anti-sera could prevent infection in dogs in contact with actual cases, while the use of a vaccine would develop a solid immunity. He showed, further, that this disease may occur in silver foxes and that the same treatment is effective. Following upon the outstanding researches of Laidlaw and Dunkin, Dalling was able to modify their methods so that production of vaccine, virus and serum could take place on a large scale. He succeeded in preparing virus in a dried form which retains its potency over long periods. He also investigated to some extent feline enteritis and showed that a virus is probably the cause of this condition and that the animal could be protected by the use of a vaccine.

Dalling also worked upon the intradermal tuberculin test in cattle and showed that reactions may be variable and in a percentage of cases doubtful.

For some years Dalling has taken a lively interest in, and worked upon, the common diseases of poultry and with co-workers has investigated fowl paralysis from the hereditary transmission point of view.

It is clear that such a varied research career will prove of great value to Professor Dalling in his future work at Cambridge.

The Veterinary Record
February 20th, 1937.

The Appointment of Professor Dalling

OUR readers will be pleased to learn that the Electors of the Professorship of Animal Pathology, University of Cambridge, have selected a member of the veterinary profession to succeed Professor Buxton. Although ourselves confident that such a choice would be made we nevertheless congratulate the University upon its decision both because the new professor is one in whom we may all have the greatest confidence and because he is essentially a veterinary surgeon of proved powers as a scientific investigator. Competition for the post was keen and to those members of our profession who might have proved themselves to be efficient if the opportunity had not been denied them, we offer our sympathy. Nevertheless, the whole of the profession, including the disappointed candidates, will feel certain that, under the leadership of Professor Dalling, the Institute of Animal Pathology will continue to play an ever-increasing part in the elucidation of our problems concerned with the diseases of animals. Furthermore it is to be expected that under his direction and with the development of the new post-graduate course in animal pathology at the University, the institute will serve with distinction not only the cause of scientific research but also that of higher veterinary education. In the future the importance of the institute in the realm of veterinary education and research will thus be even greater than in the past and both the profession and the University may count themselves fortunate that one so able as Professor Dalling will be at the helm. We extend to him our best wishes for both his personal success and that of the institute he is called upon to direct.

The Horse

WE reproduce elsewhere in this issue Mr. E. Brayley Reynolds' presidential address delivered to the Eastern Counties Division of the N.V.M.A., and seize this opportunity to suggest to our readers that they should read this address with more than usual care, for we feel that there is much in it to provide food for careful thought.

With the development of veterinary research work during the post-War years there has been an ever-increasing amount of attention paid to the so-called "food animals" and to the small domesticated carnivora; all but the most pressing problems concerning horses have been neglected.

For years it has been fashionable to reiterate some such hypothesis as "the days of the horse are over," and there has been a temptation to accept this as a statement of absolute fact, since there certainly have been signs that mechanical transport has been partly or wholely substituted for horse transport in many different fields for commercial purposes, for pleasure, in military transport and in coal mines. Undoubtedly, these reiterations have coloured the views of those who hold the reins of such finance as is available for veterinary research. The claims of the horse have either not been urged at all, or have been urged without sufficient vociferation—for it would seem that he who shouts loudest often gets most.

The presidential address referred to already will, we feel sure, serve a much needed purpose in enabling us to re-orientate our views of the relative importance of the horse in the complex structure of modern civilisation. The refreshingly novel view that the horse directly and indirectly plays a psychological part in the life of modern man is one which is worthy of careful examination.

Quite apart from this general consideration, however, there can be no doubt that when the healthy position of horse-breeding in this country is considered, and when the immense amount of money invested in the industry is remembered, as a profession we ought not to neglect the claims of the horse. It is probably true to say that during the years that have elapsed since the conclusion of the War, not more than some half-dozen equine diseases have been seriously investigated in Britain. It is certainly true to say that during this period, though much useful information on this or that detail of equine pathology or physiology has been accumulated, no major discovery which has markedly modified treatment or methods of prevention has been made in Britain. It is relevant to ask why this is so. The answer is not far to seek. Research into equine conditions costs more money than does research into the diseases of other animals, and this money has not been made available hitherto. Losses from at least one condition—grass sickness—have been very heavy in Scotland and the north. There has been much public agitation, in consequence. A very extensive programme of research has already been carried out—a far more extensive programme than the great majority of the members of the profession realise—and a programme the ramifications of which have probably no parallel in any other line of veterinary research. That most of the many avenues explored should have yielded little or nothing in the way of results, is no cause for dissatisfaction. Those avenues, so carefully and meticulously explored, need not be re-examined. The negative evidence is of immense value. A most fascinating story will have been told when the final chapter of the history of grass sickness research has been written.

Of other equine disease conditions it is difficult to cite even one which has received anything like adequate attention. The so-called osteo-arthritic syndrome has been accorded considerable prominence of recent years. Much preliminary observational data has been accumulated and an attractive theory has been propounded, but it is as yet unsupported by real experimental work. There are evidences now that the Agricultural Research Council, both from its own monies and from funds from such bodies as the Betting Control Board, which it administers, will grant financial facilities for the more adequate conduct of research work into diseases exhibiting these osteo-arthritic phenomena. Through the agency of the Thoroughbred Breeders' Association sums of money are now available for research into two very important major problems confronting the breeders of thoroughbreds in particular, but also of horses in general—strongylosis and reproductive disturbances. These schemes of work are already initiated, and if sufficient support is forthcoming, there is little doubt that we can confidently look forward to much progress in future. There are, however, many equine complaints upon which exhaustive and reliable information is still lacking. We might mention such conditions as so-called "Newmarket cough," "heel-bug," equine influenza,

ringworm, strangles, streptococcic abortion, "summer mastitis," and many others. Although some of these may be at the moment of local incidence, this fact is no indication of their possible distribution in future. There is indeed a wide scope for active research.

We feel that one pregnant phrase in the address mentioned should be emphasised, in particular, in its bearing upon equine research—*viz*, "closer co-operation with the practitioner in the field." Results obtained in the realms of pure research may be almost useless unless they can be translated into practice. For that translation—and indeed for much of the preliminary work—an integral cog in the research machine should be the veterinary practitioner. There has been, unfortunately, some evidence in the past that when co-operation has been sought by the research institutes with the practitioners, it has not always been freely forthcoming. Communications are sometimes disregarded, questionnaires may remain unanswered, and schemes for the collection of information and material, so often essential in the early stages of an investigation, are disappointing in the results they yield.

If a new era is to dawn in veterinary research, or perhaps we should say if the era which has already dawned is to mature and develop to best advantage, the practitioner must be prepared to co-operate to the fullest extent and make available that vast store of knowledge which, perforce, he accumulates in the course of his daily routine practice. On their part, as advised in the address, research workers might well take into their confidence and call into consultation the general practitioners to a greater extent than they do. There have been instances of the giving of advice regarding treatment, based upon results obtained in the laboratories, which has been found quite inapplicable in practice. Such instances are calculated to lower the prestige of, and confidence in, the research worker, and might readily have been avoided if some form of consultation and mutual co-operation had existed earlier. If further justification for such a course is needed, it can be summarised by saying that the conception and operation of a co-ordinated country-wide scheme of research in which laboratory workers, practitioners and even public health officials were integrated into an harmonious team and in which each unreservedly did his due share of the work, would be more than sufficient to secure full support from the relevant governmental and other authorities and assure to our profession that due recognition of its right to plan, conduct and carry out investigation of animal disease, which has hitherto been in a large measure denied.

Future prospects are encouraging, but wholehearted support and co-operation from the members of all our ranks are essential if we are to realise our ideals.

The latter part of the address opens up a subject upon which there will doubtless be many opinions. The remarks regarding the curriculum could readily be extended to form an editorial article devoted to veterinary education exclusively. It seems to be desirable now only to draw the attention of all our readers to them, and to say that we hope that before the Council of the R.C.V.S. decides to make static a curriculum which is at present perforce fluid, it will take into the most careful consideration such views as those expressed by Mr. Brayley Reynolds, and such other opinions as may be ventilated in our columns.

BOVINE TUBERCULOSIS IN THE IRISH FREE STATE

1936 Return

The following official Return, issued by the Department of Agriculture (Veterinary Section) of the Irish Free State, shows the number of outbreaks of tuberculosis during the twelve months ended December 31st, 1936. In this Return the term "outbreak" signifies each separate place where animals were found suffering from tuberculosis of the udder, tuberculous emaciation, giving tuberculous milk, or affected with chronic cough and showing definite clinical signs of tuberculosis.

Districts of Local Authorities:—	No. of Outbreaks.	No. of Animals declared affected.
Boro' Dublin	18	18
County Cavan ...	8	8
„ Donegal ...	79	79
„ Clare	74	74
„ Cork	286	301
„ Kerry	511	527
„ Limerick ...	423	433
„ Tipperary N.R.	47	48
„ Tipperary S.R.	226	242
„ Waterford ...	134	138
„ Carlow ...	6	6
„ Dublin ...	14	15
„ Kildare ...	16	17
„ Kilkenny ...	91	93
„ Laoighis ...	8	8
„ Longford ...	18	18
„ Louth	6	7
„ Meath	10	10
„ Offaly	21	21
„ Westmeath ...	25	26
„ Wexford ...	59	60
„ Wicklow ...	22	23
„ Galway ...	16	16
„ Leitrim ...	7	7
„ Mayo	25	25
„ Roscommon ...	25	25
„ Sligo	13	13
Total ...	2,188	2,258

CLINICAL COMMUNICATIONS

Spinal Dislocation

HAMILTON KIRK, M.R.C.V.S.

An Airedale, four years old, which had been knocked down by a car, exhibited symptoms of shock and spinal concussion upon examination soon afterwards. During the following week the animal evinced great distress, especially if moved, and seemed to resent interference with the spinal column. The paraplegia showed no sign of abating, and incontinence added to our difficulties. There was also a curious stiff extension of the near fore-limb, although the off fore-leg appeared quite normal. At first I considered the hind quarter paralysis might have been consequent upon a severe contusion of the spinal column, and the owner was informed that if my contention was correct there would be a gradual re-absorption of the serous fluid which caused pressure upon the cord, and a progressive ability of the dog to use its legs. This happy result, however, did not materialise and I began to suspect fracture. An X-ray photograph was accordingly taken, which, as the illustration shows, disclosed a serious dislocation of the seventh dorsal vertebra; in fact, the fifth, sixth and seventh vertebrae appeared to have been thrust out of line with the remainder. In addition, the supra-spinous process of the eighth vertebra appears to be fractured.

Spinal dislocation is rare among dogs, and it certainly could not have been diagnosed clinically in this case without the aid of X-rays. The skiagraph, here reproduced, is not so sharp as one could desire, but this was due to a reduction of exposure time in consequence of the dog's rapid breathing, trembling, and the movement caused thereby. It became quite obvious that the spinal cord had been crushed and that resolution could not occur until the luxation was reduced. Even then the prognosis was grave. As I could conceive no method of effecting such a reduction owing to the depth of the vertebra from the surface, the owner was informed that the most humane and economic procedure would be to put the animal to sleep. To this he refused to consent. I then suggested that the dog might be taken to the Royal Veterinary College for a confirmatory opinion, but although this course was agreed to, it was not adopted. At the end of a further week I telephoned for news of the dog and was told

[*Radiograph by H. Kirk.*

another veterinary surgeon had charge of the animal. My information was that the injury was considered by him to be merely spinal concussion, easily curable by massage, and that an examination of the radiographs was unnecessary.

* * * * *

A Large Tooth*

W. H. WORTLEY, M.R.C.V.S.
Bungay, Suffolk

The subject was a shire gelding, 15 years old, which the owner, at the time he sought advice, thought was paralysed in its throat as it was unable to swallow food. When first seen it certainly looked very tucked up and as if it had been completely starved for a week. Salivation was profuse and "quids" of food, chiefly grass, were numerous. No discharge or offensive odour from the nostrils could be detected, although the attendant stated that both had on occasions been observed four months earlier while the horse was at work during the winter; nor was there any outward deformity of the maxillary bones.

Examination of the mouth revealed that the molar teeth on the left side were normal in size and number, but that there were seven in both the upper and the lower jaw on the right side. In addition to this increase in number, the fifth molar in the upper jaw was abnormally large. With the exception that there was a pronounced downwardly projecting "spike" at the posterior edge of the seventh molar in this jaw the surfaces and external borders of the tables of the teeth were in line; there was, however, considerable projection of the large fifth molar towards the palate, and a distinct gap, about a quarter-of-an-inch wide, existed between this tooth and the next immediately behind it, filled with offensively smelling decaying food.

Treatment.—After anaesthetising, the spike on the seventh molar was taken off by shears and attempts made to extract the fifth tooth, but these were not successful; and punching was not resorted to. The sixth molar was extracted in an endeavour to deal with the infected space, but as little or no improvement took place the animal was destroyed.

Post-mortem Examination.—The large tooth could only be removed by chiselling away the surrounding bone. The superior maxillary sinus was practically obliterated by the root of this tooth and a surrounding ostitis. Two fistulae existed and opened one in front of and one behind the fifth molar.

*Case reported to a meeting of the Eastern Counties Division, N.V.M.A., at Great Yarmouth.

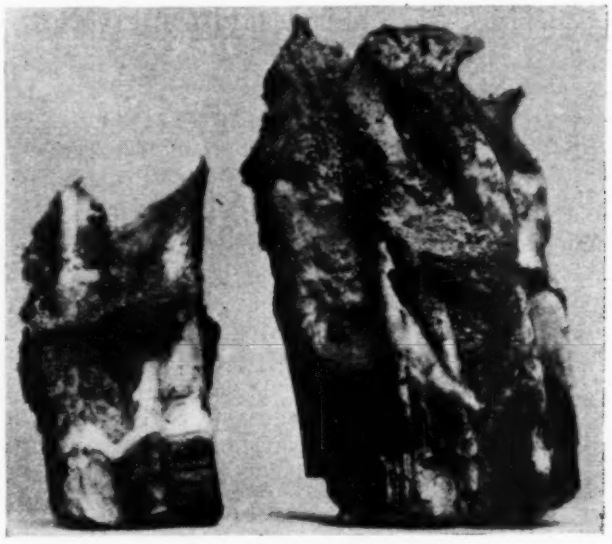


Plate 1.—Showing external surface of fifth right upper molar in comparison with that of the corresponding tooth of the left side.

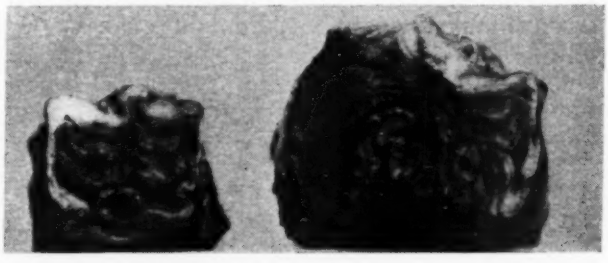


Plate 2.—Showing comparison of crowns of same two teeth.

* * * * *

Tuberculosis of the Skin in the Pig (?)*

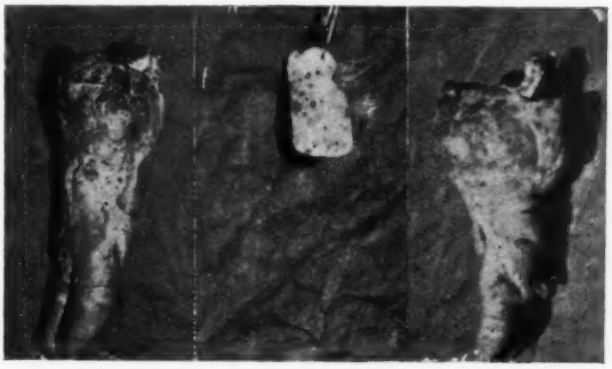
P. McDONNELL, M.R.C.V.S.
Veterinary Officer, Limerick

The subject of this note was a sow; breed, large white York; age about two years; weight two hundredweights, one quarter, four pounds. The animal arrived at the factory with two others, and it was noticed that this particular animal was lame, a swelling being present about the knee in the off fore-leg. The animal was slaughtered in due course. *Post-mortem* examination of viscera and carcase revealed generalised tuberculosis. The animal was pregnant, five fully developed foetuses being present in the uterus; the latter, however, showed no lesions.

The lesions in the skin were present in the neighbourhood of the swollen joint and along the skin of the abdomen as can be seen from

*The writer is assuming that the lesion in question is tuberculosis. While this assumption may be correct, no assertion can be made in the absence of microscopical or other confirmation. —*Editor.*

the accompanying photographs, the small photograph being that of a piece of skin from the abdomen.



Some of the lesions appeared in the form of ulcers or small shallow erosions and others in the form of small projecting tubercles, about the size of a small pea. These latter when cut into, were of a caseous nature and yellowish in colour.

In the course of inspecting approximately half a million pigs the writer has never seen another case of tuberculosis of the skin. Hutyra and Marek make only passing reference to cutaneous lesions in the pig. In speaking of infection of bones and joints they state: "Now and then the process extends to the skin from which point the accumulated cheesy-purulent masses are discharged." That would account for the lesions around the carpal joint, but how did the process extend to the skin of the abdomen?

SUBSTITUTE FOR ARSENIC IN INSECTICIDES

A poison which can be used instead of arsenic in insecticides and is not injurious to human beings has been discovered in Brazil. It is called "Timbo" and is a new export commodity of the Amazon Valley. It is described in a Department of Overseas Trade report which was issued on January 28th.

The word "timbo" is derived from an Indian word which the natives of the Amazon Valley use to denote any plant, shrub, or tree from which they extract poison, which they employ in catching fish in the rivers. Recent experiments, says the report, have shown that "rotenona," the basis of the poison, can replace arsenic as an ingredient in insecticides and eliminate the danger in their use, as it is not injurious to man or warm-blooded animals.

"Timbo" can be exported either as a root or a powder, but to encourage local industry export in powder form only has hitherto been allowed from the State of Para. The largest importer is the United States, which took 227 tons of the total exports amounting to 253 tons in 1935.

* * * * *

Exhibitors of horses at the Essex Agricultural County Show this year will not have to send their animals into the veterinary ring on the day of the show if they produce, within seven days of entry, certificates of soundness from a qualified veterinary surgeon. The right of having animals examined by the veterinary referees was reserved.

ABSTRACTS

[Prophylactic Treatment of Brucellosis in Cows by Volkmar's Solutions and by Sufrogel. Zeller, H., and Stockmaier, W. (1936.) *Zschr. Hyg. v. Infektr.* **50.** 23. 165-179.]

Six abortion-free pregnant heifers received a prophylactic course of treatment for contagious abortion as advocated by Volkmar. This consisted of 13 daily injections of 100 c.c. of mixed mineral solutions. Two days after the last injection virulent *Brucella abortus* was introduced into the rumen of each animal by means of a probang. Six more therapeutic injections of Volkmar's solutions were then administered. Six similar heifers received three prophylactic intramuscular injections of "sufrogel" (a colloidal suspension of sulphur in gelatin) followed by a test dose of virulent *Br. abortus*. Thereafter four alternating doses of "sufrogel" and virulent *Br. abortus* were administered followed by three final injections of "sufrogel." The whole procedure lasted 100 days.

All twelve heifers treated in these extremely complicated ways developed specific antibodies during the course of a few weeks. All the animals eventually aborted, all but two showed serious uterine disorder as judged by the state of the foetal membranes, and in all cases the udder became infected.

These findings indicate that both methods of treatment are valueless. The authors emphasise the fact that more attention should be paid to such definite failures in treatment than to claims of the successful use of these agents.

E. J. P.

* * * * *

[Infectious Bovine Mastitis. Report on a Control Programme Based on Segregation of Affected Animals. Plastridge, W. N., Anderson, E. O., Weirether, F. J., and Johnson, R. E. (1936.) *J. Dairy. Sci.* **19.** 10. 641.]

Six herds free from contagious abortion and tuberculosis were examined to study the possibility of diminishing the incidence of bovine mastitis by segregation methods. For diagnostic purposes, quarter samples of milk from all cows were examined at three monthly intervals. As a result of these examinations animals were classified as:—

(1) Those free from mastitis.

(2) Those infected with mastitis other than streptococcal types.

(3) Those infected with streptococcal mastitis except that caused by group A streptococci (the bulk of these cases corresponded to Group III, Minett, Stableforth and Edwards).

(4) Non-clinical cases of group A streptococcal mastitis (*Str. agalactiae*).

(5) Clinical cases of group A streptococcal mastitis.

Animals in each herd were arranged in the barn and were milked according to the order suggested by the above classification and careful hygienic precautions were practised in the handling of the cows.

It was found that by following this segregation plan the rate of spread of mastitis could be reduced by from 50 to 100 per cent., but it is emphasised that to eliminate spread entirely, complete segregation of infected animals is essential. In one herd in which infected animals were gradually replaced by clean heifers the disease was completely eliminated, whilst a herd recruited from pregnant heifers remained free from infection.

E. J. P.

* * * * *

[Detection of Shedders of Streptococci Responsible for Infectious Bovine Mastitis. Plastridge, W. N., and Anderson, E. O. (1936.) *Amer. J. Pub. Health* (Reprint). **26.** 7. 711-715.]

The streptococci isolated from 970 aseptically-drawn samples of milk could be placed in one of three groups. The characters of group A resembled those of *Str. agalactiae*, widely recognised as the cause of chronic mastitis. Members of group B differed from those of group A by fermenting mannite, by reducing methylene-blue milk and by fermenting either inulin or raffinose or both. The third group contained streptococci similar to those occurring as saprophytes of the mouth, skin and excreta of cattle. Of 828 group A cultures, 97 per cent. were recovered from milk samples in which there was evidence of mastitis as revealed by increased cellular content and alkalinity and so also were 46 of the 56 group B cultures; only 3 out of 86 cultures classed as saprophytes were from diseased quarters.

In order to ascertain the most effective method of detecting streptococci, the value of the following procedures was compared on 360 samples—(*a*) cultural examination by streaking blood agar with whole milk, with sediment from 10 c.c. milk, and by making standard dilutions in the medium; (*b*) microscopic examinations of whole milk, sediment and of samples incubated overnight at 37° C. The last-mentioned method proved the most effective and revealed the presence of streptococci in 97 per cent. of the samples collected from animals affected with chronic streptococcus mastitis. About 13·5 per cent. of the samples from apparently healthy quarters also yielded streptococcus chains by this method and in view of this finding the authors state that when there is no other evidence of mastitis the organism should be isolated and identified.

S. J. E.

REPORT

Army Veterinary Services

STATISTICAL AND GENERAL REPORT, 1935-1936

This report covers the work of the Army Veterinary Service at home and in Egypt; the Royal Army Veterinary School, at Aldershot, and its laboratory, and the Army School of Farriery, at Aldershot, for the year 1935-36.

Animals

The following is a summary of the strength of the Army in animals and of the incidence of sickness, inefficiency and wastage during the year under review:—

	Average strength.	Average age.	Average number daily under treatment.	Percentage wastage, vererinary reasons.
Home				
Horses ...	12,036	11·37	638·30	5·59
Mules ...	210	16·27	3·43	4·76
Egypt				
Horses ...	1,845	12·59	136·33	8·54
Mules ...	527	12·76	21·59	3·59

One thousand and fifty-four remounts were purchased during the year, representing 9 per cent. of the strength of the Army, as against 1,579 purchased in 1934-35.

The general health and condition of the animals was good. Special mention is made of the high standard of animal management among units in Egypt.

Diseases

General Diseases.—In home commands 715 cases of simple fever and 162 of debility are recorded under this heading. There were five cases of grass sickness, all in southern England, of which two died and two were destroyed.

Respiratory Diseases.—The admissions numbered 1,562, the chief causes being catarrh, coughing, laryngitis, roaring, broken wind and pneumonia. A coughing epidemic affecting 751 horses made its appearance during the summer, mostly in the southern and eastern commands.

Digestive System.—There were 954 admissions under the headings of colic, indigestion and entozoa. Four hundred and eighty-two horses were treated for worm infestation.

Skin and Connective Tissue.—The principal causes were acne, dermatitis and ringworm, the total admissions being 801. There were no cases of sarcoptic or psoroptic mange.

Surgical Conditions.—One thousand two hundred and nineteen admissions.

Injuries.—Five thousand two hundred and thirty-one admissions.

Specific Diseases.—Strangles, 184 cases, was the major contribution under this heading. One case of anthrax occurred in a horse at Exeter.

Royal Army Veterinary School

Educational Work.—Four courses of instruction were held in animal management for officers and N.C.Os. of the combatant branches of the Army.

Laboratory Work.—Eight hundred and fifty-four examinations were made, the majority of the specimens being faeces submitted for report on the presence of helminth ova.

The productive work of this laboratory is recorded as under:—

Stock catarrh vaccine ...	640 doses
Autogenous vaccines	148 doses
Stock pustular dermatitis vaccine	2,152 doses
Spleen extract	1,440 doses
Mallein, subcutaneous method	3,309 doses
Mallein, I.D.P. method ...	14,482 doses

The reports received from veterinary officers on the use of the various vaccines suggest that these products proved of real value in the treatment of disease.

No difficulties were experienced in connection with mallein production during the year.

Research Work.—Research work on the normal flora of organisms in the nasal passages of horses was continued with a view to establishing later the cause of various respiratory diseases in horses.

Many observations were made in connection with the pathology and diagnosis of navicular disease in horses.

Radiological Work.—The X-ray work was continued without a break during the year and proved of great diagnostic value. Further improvements were made in technique which permitted a widening of the scope of the work. Eight hundred and twenty-six radiographs were made, interpreted and reported on during the year and in 64 cases these were subsequently supported by *post-mortem* examinations.

In view of the growing importance of radiological work and the valuable contribution to the advancement of this science made by this school, the very brief reference made to this subject in this report is disappointing. During the period under review, a comprehensive article by the officer in charge of this department has, however, appeared separately in this journal. (See *Veterinary Record*, **15**. 48. pp. 1433-1446.)

School of Farriery

Instructional Work.—The average daily number of students under instruction at this school was 31·6. During the year 56 qualified, representing 86·96 per cent. of those examined. The average duration of attendance of each pupil was 6·86 months.

In addition, 14 farriers attended refresher courses during the year and six the advanced farriers classes. Trade testing of regimentally trained farriers was also carried out at the school with passes as follows: Class I, three; Class II, eight; Class III, five.

Productive Work.—One thousand nine hundred and two horses were shod at the school during the year: 7,308 shoes were put on: 2,951 shoes were made.

C. D.

REVIEW

[Statistical Methods for Research Workers. By R. A. Fisher, D.Sc., F.R.S. Sixth edition. Published by Oliver & Boyd, Edinburgh. Price 15s. net.]

It is becoming more and more necessary for the research worker to ensure that his experiments are satisfactorily planned from the statistical point of view. This does not mean solely that the experiments should be made in a sufficient number of replicates, but that questions of groupings and controls should be adequately considered. It is often thought that the experimentalist can take his results along to a statistician and the latter will be able forthwith to give a clear answer to the questions put forward by the experimentalist. It is seldom realised that many experiments should be planned conjointly by the statistician and the experimentalist if the true answer to the problem being examined is sought. In biological work the need for statistical planning is even greater than with many other types of experiment owing to the relatively large differences that may be exhibited by two individual animals submitted to the same experimental conditions. This variation may be still more disturbing if the effect of some variant is small, as may often be the case when work is being carried out on problems connected with the diseases of animals. Indeed, much work on the domesticated animals is of restricted value owing to the complete absence of any attempt to make the experiments statistically valid and satisfactorily controlled.

Fisher's book is indeed valuable to all those research workers who would endeavour to gain the statistical outlook. In spite of the omission of most of the mathematical proofs of the important propositions underlying theory, however, the text is not easy reading but requires concentrated effort. The subject cannot be made an easy one to the individual with no aptitude for mathematics, and a certain amount of common sense must be applied throughout, as few of the methods are fool-proof. An understanding of the chapter on "Distributions" is essential, and fortunately, this chapter is easier

than many of the others. A great advantage of "Fisher" is the inclusion of a very complete set of tables. To the veterinarian, who has frequently to work with expensive animals, the method of small samples propounded by Fisher is of considerable importance.

It is certain that the worker on animal diseases would gain much from a study of this and other works on statistical methods, while a perusal of the series of elementary articles at present appearing in *The Lancet* would afford an easy introduction to this excellent work of Fisher. That a work of this nature should pass so rapidly through six editions is itself eloquent testimony of its value. The printing and paper make it an attractive book with which to work.

"ANCIENT REMEDIES AND CURES FOR FARM ANIMALS"

Mr. W. R. Kerr, M.R.C.V.S., D.V.S.M., of the Veterinary Research Laboratory, Stormont, took the above as his subject when lecturing to the Belfast and District Section of the Institute of Chemistry of Great Britain and Ireland on January 1st. Commencing with a reference to the primitive medicine and surgery of prehistoric man, Mr. Kerr went on to say that the first real knowledge of medicine and disease came from the Greeks, who had an extensive knowledge of the subjects.

The ancient practice of curing diseases was by poetry and music. Democritus said that many diseases were cured by the sound of the flute properly played. In the West of Ireland to-day the doctor with the lucky hand was to be preferred to the one with academical qualifications—a relic of an ancient practice.

Another interesting remedy was "sympathy" or "like to like." The eyes of the swallow, said to be the bird with the most acute vision, were roasted and powdered into a salve for eye affections. The raw heart of a warrior, or, if that was not available, the heart of a lion, was a tonic.

Veterinary treatments followed human medicine fairly closely. The Roman armies had a definite veterinary service. In later times the science fell very much into the hands of quacks, grooms, and farriers. The speaker, continuing, gave some interesting illustrations of animal diseases and their somewhat surprising treatment.

A very persistent ancient belief lasted from A.D. 50 until the 17th century. If a shrew mouse ran over, or bit the legs of an animal or man, the legs became paralysed. The cure was to take a shrew mouse, place it in a hole in a tree, and plaster up the hole. A branch from that tree, stroked over the affected animals, effected a cure. For convulsive disorders due to evil spirits, the ashes of a white hound, baked with meal, were reputed as an efficacious healer. Ox bile was used to cure obscurity in vision, fox loin fat for sore ears, ram's lung for ulcers, extract of any brain for headaches. Such remedies were practised up to comparatively modern times.

In the 17th century, the leading authority, Markham, had three remedies—(1) diapente with blood letting, believed to be capable of curing 30 diseases; (2) asafoetida and vinegar, to cure 14 diseases; and (3) pepper and lard, for the treatment of abscesses and ruptures. He also dabbled in organo-therapy as practised in the previous centuries.

Royal College of Veterinary Surgeons

SPECIAL MEETING OF COUNCIL

No. 9, Red Lion Square to be Acquired for Additional Accommodation

At a Special Meeting of Council held at the College, 10, Red Lion Square, London, W.C.1, on Tuesday, February 2nd, 1937, there were present Mr. J. Willett (President) in the chair, Professor J. B. Buxton, Major G. W. Dunkin, Sir Frederick Hobday, Major Hamilton Kirk, Messrs. G. Livesey, G. H. Locke, A. MacKenzie, Lieut.-Colonel W. S. Mulvey, Lieut.-Colonel P. J. Simpson, Mr. A. Spicer, Major F. J. Taylor, Captain W. K. Townson and Professor G. H. Wooldridge.

The minutes of the previous Special Meeting were read and signed as correct.

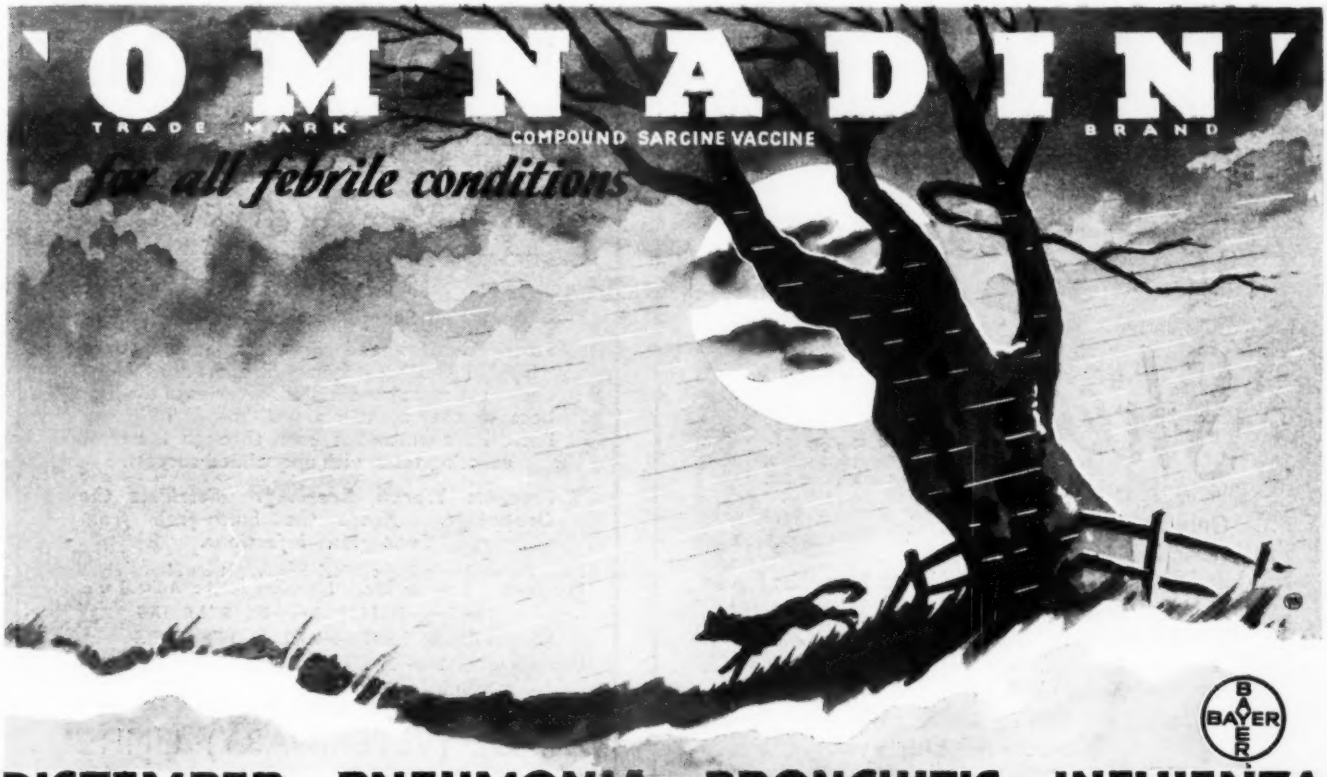
Letters of apology for absence were received from the following: Dr. O. Charnock Bradley, Messrs. J. C. Coleman, H. W. Dawes, J. Holroyd, J. W. McIntosh, G. P. Male, W. Nairn, Professor J. J. O'Connor, Mr. J. F. D. Tutt, Colonel G. K. Walker and Dr. A. W. Whitehouse.

Additional Accommodation

House Committee.—The following report of the meeting of the House Committee held on January 18th was read and approved:—

> The minutes of the previous meeting were read and signed as correct.
>
> *Additional Accommodation.*—A letter was received from the owner of No. 9, Red Lion Square stating that he was now able to offer the whole of the freehold premises without the restriction formerly laid down that the use of the first floor could not be obtained until the expiry of a tenancy with 16 years to run.
>
> After due consideration it was resolved:—
>
> (*a*) "That the scheme for the reconstruction of the south side of the College building be not proceeded with for the time being.
>
> (*b*) "That the President and Treasurer be authorised to meet the owner of No. 9, Red Lion Square to negotiate for the purchase of the freehold property."

The President reported that earlier in the day, in company with the Treasurer and assisted by the Solicitor and Surveyors, he had had an interview with Mr. Davis, the owner of No. 9, Red Lion Square. Mr. Davis had explained that the lease of the first floor would terminate at mid-summer, 1937, and the lease of the second floor at Michaelmas, 1937, the third floor being let on a quarterly tenancy. He expressed his willingness to sell the freehold property, subject to his being allowed to continue the tenancy of the ground floor for the remainder of his life or his active participation in the business at a rental of £150 per annum. The price he asked was £10,000, and he had refused to consider any lower figure.



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It was unanimously resolved:—

(*a*) "That the freehold property No. 9, Red Lion Square be purchased for the College at a cost of £10,000, subject to the condition stated, and that the Solicitor be instructed to complete the purchase."

(*b*) "That the House Committee be authorised to deal with any matter arising during the negotiating of the contract and the completion of the purchase."

In reply to a question as to whether the College was empowered to hold property except for the occupation of the College officials, the Solicitor stated that by the Charter of 1876 the Council was authorised to acquire lands or buildings to the yearly value of £3,000, *over and above* the value of any lands or buildings used for the purposes of the College.

N.V.M.A. DIVISIONAL REPORTS

Eastern Counties V.M.A.

SUMMER MEETING AT GREAT YARMOUTH*

The summer meeting of this Division was held at the Royal Masonic Assembly Rooms, Great Yarmouth, on Thursday, July 9th, 1936, with the President, Mr. E. Brayley Reynolds, in the chair.

In addition to the President, there were present: Messrs. T. E. Barcham, F. Blakemore, J. M. Currie, R. E. Glover, S. E. Hill, W. Shipley, J. F. Thurston, W. Turtill, R. P. Webber, P. Welch, W. H. Wortley and the Hon. Secretary. Messrs. G. Gray Skelton and M. Senior were present as visitors.

The minutes of the last meeting, as published in the *Veterinary Record*, were taken as read and signed.

Obituary.—The PRESIDENT said he felt sure that all present would not wish to allow that occasion to pass without some reference to the loss the profession had sustained by the death of Professor J. Macqueen. He did not think he could add more to what had already been said as to the greatness of Professor Macqueen, except that he belonged to that class of man, now almost extinct, who gave all his time to the study of the horse. All members then stood for a few moments as a token of respect to the memory of Professor James Macqueen.

Correspondence.—(1) From Messrs. M. Bray, D. Blyth, H. Buckingham, J. Buckingham, J. L. Buckingham, A. F. Castle, H. F. Downe, W. H. Dennett, F. Gooch, D. Jack, senr., Sir F. Hobday, Messrs. W. F. Howes, T. G. Heatley, G. T. Matthews, H. P. Standley, senr., H. Swann, W. R. Townson, P. R. Turner and W. Waters regretting their inability to attend the meeting.

(2) Letters from the N.V.M.A. with reference to the resolution submitted at the last meeting of the Council of the Association, regarding the sale of biological products. These letters reported the steps that were being taken by the N.V.M.A. with reference to this matter.

New Member.—Mr. R. P. Webber was elected to membership of the Association.

Jubilee Committee.—It was reported that this committee, which was formed with the idea of making arrangements for the celebration of the Diamond Jubilee Year of the Association, had met three times, and tried to arrange a dinner-dance, but owing to lack of support had regretfully to abandon the proposal.

Next Meeting.—It was decided to hold the next meeting at Newmarket. In this connection, the Jubilee Committee was asked to meet, in the hope that the Jubilee might be celebrated by giving a donation to the Benevolent Funds, and they were asked to devise some scheme for carrying this into effect.

The PRESIDENT then delivered his address, taking as his subject "Present-day Horse Practice." [The President's address is reproduced elsewhere in this issue.—*Editor.*]

On the proposal of Mr. SHIPLEY, a hearty vote of thanks was accorded, amidst applause, to the President for his address.

Post-mortem Specimens.—Major WORTLEY exhibited two upper molar teeth of a cart gelding, 15 years old, one tooth being more than its normal size, and weighing 8½ oz. [Major Wortley's account of this case is transferred to our Clinical Section.—*Editor.*]

The PRESIDENT exhibited the spleen of a two-year-old thoroughbred colt.

At the conclusion of the business meeting, the members and their ladies partook of tea at the kind invitation of the President and Mrs Brayley Reynolds, who were cordially thanked for their hospitality on the call of Major WORTLEY, seconded by Mr. P. WELCH.

Bowls Tournament.—After tea the bowls tournament for the Shipley Cup was played. This resulted in a win for Mr. W. Turtill, who overcame the President in the final match.

The subscription on behalf of the Benevolent Fund in connection with this tournament amounted to £3 8s. 6d.

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Autumn Meeting at Newmarket*

The autumn meeting was held at Newmarket on November 17th, by the kind invitation of the President, Mr. E. Brayley Reynolds, who had arranged a clinical demonstration, including some interesting surgical cases, at his Infirmary.

*Received for publication January 29th, 1937.

*Received for publication February 8th, 1937.

This demonstration proved an unqualified success. It was greatly appreciated by everyone present, and was most instructive.

Among the cases demonstrated were:—

(*a*) A three-year-old thoroughbred colt, from the inner side of the right fore metacarpal of which had been removed sequestra and ossific outgrowths, resulting from direct injury as a foal. This case was illustrated with good radiographic plates.

(*b*) A two-year-old thoroughbred filly upon which oesophagotomy had been performed some four weeks earlier for the removal of a dried, impacted mass of masticated hay.

(*c*) A nine-year-old thoroughbred mare having a minute vagino-rectal fistula was used to demonstrate the care with which clinical examination of the female genital organs should be made, and the methods of collecting material from them for pathological examination.

(*d*) A case of pin firing for sprained tendons, comparing the possible advantages or disadvantages of this and line firing.

Other demonstrations included:—

(*e*) The use of the laryngoscope. This was demonstrated upon a shire gelding that had suffered from acute dyspnoea, the result of a rapidly-progressive double-sided paralysis of the larynx.

(*f*) The use of the ophthalmoscope.

(*g*) A short practical demonstration in dentistry, including the use of new pattern tooth forceps and rasps.

(*h*) The method (in detail) employed in making, duplicating and filing examination certificates in accordance with the suggestions of the special sub-committee of the R.C.V.S., chiefly in view of the great importance of the identification of horses for export and import.

After the demonstration, members were entertained to tea by the President, a short business meeting following.

In addition to the President, members present were: Messrs. W. J. Bambridge, F. Blakemore, D. Blyth, T. J. Bosworth, J. D. Broome, E. Burgon, A. F. Castle, J. Currie, W. H. Dennett, R. E. Glover, T. G. Heatley, S. E. Hill, G. H. Leader, T. Love, W. F. Loveless, G. T. Matthews, C. C. Nesling, N. F. Pollock, R. Burgess Smith, H. P. Standley, senr., H. C. Swann, J. F. Thurston, W. R. Townson, P. R. Turner, W. Waters, R. P. Webber, W. H. Wortley and the Hon. Secretary. Visitors present were Messrs A. H. Dawson, A. J. James, J. G. Murray, J. S. Paterson, G. Gray Skelton and E. Wardrop.

Owing to unavoidable circumstances, the minutes of the last meeting had not yet been published, and it was decided to hold them over until the next meeting.

Correspondence.—(1) From Messrs. J. L. Buckingham, H. Buckingham, W. Browning, M. Bray, F. L. Gooch, Sir F. Hobday, Messrs. J. Hammond, A. Millar, J. Porrett, W. Turtill and P. J. Welsh, apologising for absence.

(2) From Professor J. B. Buxton, tendering his resignation from membership, in view of his departure from the area of the Division.

The President, observing that Professor Buxton had done a great amount of work for the Association, proposed that he be elected an Honorary Associate. This was seconded by Major Wortley and carried with applause.

(3) From the N.V.M.A., with reference to the protection of animals against gas warfare, asking the Secretary to get into communication with the Branches of the B.M.A., who were arranging the courses of instruction on this important matter.

New Members.—The following were elected to membership of the Association: Messrs. F. D. Boughey, A. H. Dawson and A. J. James.

It was decided to hold the next meeting at Norwich during the month of February.

Clinical Discussion.—Mr. P. R. Turner mentioned a case with which he had met, pointing to the toxicity of privet. Six Suffolk horses were at plough on a field, part of which was bounded by a privet fence, and, on turning, four of the horses had eaten privet, the other two not being able to reach the fence. The day after, the four horses which had access to the privet were all ill, the chief symptoms being dullness, dejection, difficulty in moving, and total lack of peristalsis, unaccompanied by abdominal pain. Treatment consisted of aloes, linseed oil and stimulants. In the course of a few days all the animals recovered, with the exception of one aged horse, which had since suffered from urinary disorder.

Mr. Turner wondered if any other members had met with any similar case.

Mr. J. F. Thurston said he had met with suggested privet poisoning in young cattle. In this case, the cattle had become unthrifty and emaciated.

Vote of Thanks to the President.—Before the conclusion of the meeting, Mr. H. P. Standley, Senr., moved a very hearty vote of thanks to the President for the hospitality and for the trouble to which he had gone in giving the members such an enjoyable afternoon. He felt sure everyone had learned a great deal. Major Wortley, in seconding, observed that he thought it had been the most instructive and enjoyable meeting he had ever attended. The vote of thanks was carried unanimously.

The President, in reply, said he felt more than repaid by the good attendance, and that he was indeed gratified that his efforts had met with such approval.

H. P. Standley, Junr., *Hon. Secretary.*

Notes and News

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Feb. 24th.—Meeting of the Section of Comparative Medicine, Royal Society of Medicine, at 1, Wimpole Street, W, 5 p.m.

Feb. 24th.—Annual General Meeting of the Lancashire Division, N.V.M.A., at Manchester, 2.30 p.m.

Feb. 25th.—Silver Jubilee meeting of the South-Eastern Division, N.V.M.A., at Maidstone, 3 p.m.

Feb. 26th.—Annual Dinner and Dance of the Yorkshire Division, N.V.M.A., at Leeds.

Mar. 1st.—Meeting of the Editorial Committee, N.V.M.A., at 2, Verulam Buildings, Gray's Inn, W.C.1, 4 p.m.

Mar. 8th.—Royal Veterinary College, London, Annual Ball (in aid of the Re-Building Fund), Park Lane Hotel, W.1.

Mar. 17th.—V.V.B.F., Ladies' Guild: Dance, Princes Galleries, Piccadilly, W.

April 1st.—Annual Fees due to R.C.V.S.

April 5th.—Last day for applications for tickets for R.C.V.S. Annual Dinner.

April 7th.—R.C.V.S. Committee Meetings.

April 8th.—R.C.V.S. Committee Meetings.

April 8th.—R.C.V.S. Annual Dinner, May Fair Hotel, Berkeley Street, W., 7.30 p.m.

April 9th.—R.C.V.S. Committee and Council Meetings.

May 6th.—Nominations for Election to R.C.V.S. Council due.

May 12th.—Coronation Day.

May 13th.—Entries for D.V.S.M. Examination due.

May 20th.—R.C.V.S. Voting Papers issued.

May 27th.—R.C.V.S. Voting Papers to be returned.

June 3rd.—R.C.V.S. Annual Meeting.
Victoria Veterinary Benevolent Fund Annual Meeting.

June 10th.—D.V.S.M. Written Examination begins.

June 14th.—D.V.S.M. Oral and Practical Examination begins.

June 23rd.—R.C.V.S. Committee Meetings.

June 24th.—R.C.V.S. Committee Meetings.

June 25th.—R.C.V.S. Committee and Council Meetings.

July 5th.—R.C.V.S. Written Examinations.

July 6th.—R.C.V.S. Written Examinations.

July 8th.—R.C.V.S. Oral Examination begins.

July 26th-30th.—N.V.M.A. Congress at Bournemouth.

PERSONAL

Marriages.—Gunning-Rutherfoord. On February 8th, 1937, at St. Mary's Church, Tutbury, Staffs., by the Vicar, the Rev. C. Hudson, Oscar Vernon Gunning, D.V.M., M.R.C.V.S., of "The Hawthorns," Tutbury, younger son of Mr. and Mrs. A. J. F. Gunning, of "The Fairfield," East Grinstead, Sussex, to Edith, youngest daughter of Mr. David Rutherfoord and the late Mrs. Rutherfoord, of "Allandale," Tutbury.

The best man was Mr. Alick Floyd Gunning, the bridegroom's brother, and Mr. S. Walker, junior (cousin of the bride), was the groomsman. Members of the profession who were present as guests were Mr. and Mrs. Edwardson, Captain and Mrs. Young, Major and Mrs. Bagshaw, and Mr. and Mrs. Steele-Bodger.

The reception was held at the Parish Room, Tutbury, and later Captain and Mrs. O. V. Gunning left by motor car for Torquay. The members of the Tutbury Church Choir presented the bride with a brown leather Coronation handbag, and the bridegroom received gifts from the Tutbury Parochial Church Council and the Tutbury Band Committee.

Captain and Mrs. Gunning will reside at "The Hawthorns," Tutbury.

Captain Gunning is well known to our readers, not only as a skilled practitioner, but as one who has rendered valued service to the N.V.M.A. as a member of Council and of certain committees, while he has done much to promote the success of the Derbyshire Division, over a long period as Hon. Secretary and later as President. Captain Gunning is also the Past-President of the Society of Veterinary Practitioners. No member of the Association has been more regular in his attendance at Congress, and it is typical of his kindly readiness to assist in an unassuming way, that for many Congresses, regardless of the distractions that may lead others at times to "take a day off," he has been seen by the blackboard, faithful to his duties as Recording Secretary.

Captain Gunning served with the Canadian Veterinary Corps during the war, and has been in practice at Tutbury for about 14 years.

He is Hon. Veterinary Surgeon to the Meynell Hunt Agricultural Society and the Newborough Agricultural Society and to the Meynell branch of the Pony Club.

For some years past he has officiated as Vicar's Warden at St. Mary's Church, Tutbury.

A member of the Tutbury Priory Lodge (3,485) of Freemasons, he is also President of the Tutbury Silver Band, and in many other ways associated with the business and social life of the district.

The bride has accomplished much good work in the district. She is deputy organist and a member of the choir at St. Mary's Church, and is well known as a soprano soloist. A former Secretary of the local branch of the Junior Imperial League, she now acts as Hon. Local Secretary for the Missions to Seamen.

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Trevor-Grieg. On Wednesday, February 10th, 1937, at the Registry Office, Kensington, Salusbury Lloyd Trevor, M.R.C.V.S., of Llanover Lodge, Chepstow, Mon., son of Major and Mrs. T. G. Trevor, of "By-the-Va," Frogmore, St. Albans, to Rachel Elizabeth Grieg, daughter of the late Major R. H. Grieg, D.S.O., R.E., and Mrs. Greig, now Mrs. Godfrey Rokeling, of 16a, Longridge Road, London, S.W.5.

EDINBURGH COLLEGE EXTENSION FUND BALL

As previously announced in these columns, a Ball in aid of the extension fund of the Royal (Dick) Veterinary College, will be held on Friday, March 19th, 1937 (eve of the Calcutta Cup match at Murrayfield) in the Assembly Rooms, Edinburgh.

Lady Elphinstone, sister of Her Majesty the Queen, presides over a most distinguished committee of patronesses of this function, which will be one of the outstanding events of the social season in Scotland. The Ball, at which Highland, Hunting, Mess and Evening dress will be worn, in that order of preference, commences at 10 a.m., with regimental and clan invitation reels at 10.45 p.m., while the programme includes a midnight cabaret. Tickets (35s. single, and £3 double) are now available, and as the demand is great, early application to the College, or any of the following patronesses, is advised: Mrs. Louis S. Gumley, the Lady Provost; Her Grace the Duchess of Atholl; Her Grace the Duchess of Buccleuch; Her Grace the Duchess of Portland; Her Grace the Duchess of Roxburghe; the Countess of Airlie; the Countess of Dumfries; the Countess Dysart; the Countess of Haddington; the Countess of Mansfield; the Countess of Rosebery; the Countess of Seafield; the Countess of Stair; the Viscountess Traprain; the Lady Forteviot; the Lady Kinross; the Lady Lovat; the Lady Victoria Wemyss; Lady Adrian Baillie; Isabel Lady Baillie; Margaret Lady Blake; the Lady Hermione Cameron of Lochiel; Lady Colquhoun of Luss; Lady Dixon; Lady Seton; Lady Salvesen; Lady Hudson Beare; Lady Gilmour of Montrave; Lady Holland; Lady Leslie Mackenzie; Lady Wallace, M.B.E., Lady Whitson; Mrs. Kinloch Anderson; Mrs. Will Y. Darling; Mrs. Murray of Geanies; the Hon. Mrs. Stirling of Keir.

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ROYAL VETERINARY COLLEGE

The Executive Council of the County Councils Association has appointed the Rt. Hon. Lord Bayford and Sir Joseph Lamb, M.P., as representatives of the Association on the Court of Governors of the Royal Veterinary College in the places of Sir Edward Holland and Sir Percy Jackson, resigned.

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FAECAL CONTAMINATION OF MILK

The *Salisbury Times* reports that the "mystery illness" which recently swept Wilton Junior School has been shown to be enteritis due to a Salmonella (*Bact. enteritidis*, var. *dublin*) gaining access to the milk from the faeces of an infected "carrier" cow belonging to an "accredited" herd. Since the cow was removed from the herd no further trouble has been reported. The chain of evidence has been worked out by the county bacteriologist in association with Dr. Scott, of the Ministry of Health.

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LEGAL NOTES

Diseased Sheep Removed Before Inspection.—Drighlington Urban District Council were the prosecutors in a case at Bradford West Riding Court in which a Drighlington cattle dealer was fined £30 and costs for removing an animal before inspection by the local sanitary authority and for failing to report disease of the animal.

The solicitor for the prosecution said that the Drighlington District Council's sanitary inspector, on a visit to the defendant's farm, found a sheep had been slaughtered there. On examination it was found to be diseased.

The carcase of the sheep was later found exposed for sale in the shop of a butcher at Ossett, who was fined £5 for exposing unsound meat for sale. The District Council regarded the case as a very serious one.

An Ossett butcher stated that he bought the sheep, which had been slaughtered, from the defendant on condition that it was examined by the inspector the following day. The defendant agreed to this and removed the carcase to his slaughterhouse.

Cross-examined, in spite of the fact that he was fined at Ossett and that Dr. Wood said the animal had suffered from dropsy, he still said it was fit for human consumption. If the inspector had not seen it and condemned it, it would have gone to Dewsbury for sale.

Defendant, giving evidence, said the sheep was injured and in pain, so he killed it in an open shed. He sold it on condition that payment was not made until after it had been examined by the inspector.

* * * * *

EXPOSURE OF OVERSTOCKED COWS IN MARKETS

In a recently issued Press notice the Ministry of Agriculture and Fisheries again calls attention to the practice of exposing for sale in markets cows left unmilked with a view to distending the udders and showing the animal's capabilities. The practice is not only quite unnecessary to convince a purchaser that the cow possesses good qualities as a milker, but in a very large proportion of the cases it may involve suffering to the animal. If so, the person responsible renders himself liable to legal proceedings for cruelty under Section 1 of the Protection of Animals Act, 1911, or of the Protection of Animals (Scotland) Act, 1912, as the case may be.

An appeal was made in the earlier notice to farmers, market authorities, auctioneers and all others concerned to co-operate in discouraging this very objectionable practice. Reports which have since been received by the Ministry from various parts of the country indicate that, while the practice of overstocking continues, there is some tendency to improvement and that the feeling against the practice is growing and has been stimulated by various articles in the agricultural Press and elsewhere. In many quarters the opinion has been expressed that a more rigorous application of such penalties as are permissible under the Protection of Animals Acts should be aimed at in order to put an end to this cruel practice.

The Ministry desires to take this further opportunity of emphasising the fact that the overstocking of cows is not necessary to reveal the milking qualities of the animal and that it may not only involve severe suffering, but also have a detrimental effect on the future milking capacity of the cow. It therefore makes this further appeal to all concerned to do everything in their power to discourage and put an end to the practice referred to.

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PREVENTABLE CRUELTY ON FARMS AND IN MARKETS

We are glad to have much evidence that members of the profession are taking an increasing interest in the activities of such humane societies as the R.S.P.C.A. and that they are at all times willing to shoulder the burden of organisational work. A notable instance is

the association of Mr. R. Glave Saunders, M.R.C.V.S., of Exeter, with the Exeter East and West Devon Branch of the R.S.P.C.A. in the capacity of Hon. Secretary, and his report to the annual meeting indicated praiseworthy activity in many directions, notably in regard to humane slaughter and the provision of free treatment for the animals of poor persons under the "de-centralised" scheme sponsored by the N.V.M.A.

Mr. Saunders is also the author of the pamphlet reproduced below, the title of which forms the heading of this note, and which he has prepared for distribution in the area covered by his Branch of the R.S.P.C.A. It is a matter for some regret that this useful publication is somewhat spoilt by the comment that "many veterinary surgeons hold the view that if a cow with an over-distended udder is chewing her cud, and able to allow the surplus milk to drain away, although she may be uncomfortable she is in no actual pain. Such have, I think, a conscious, or unconscious, bias in favour of the views of the farmers, their clients; or they have never thought the question out from the standpoint of comparative physiology and pathology." Such comments are apt to be misconstrued by many, and we would suggest that Mr. Saunders should not, even unwittingly, cast these aspersions upon the honour or ability of practising veterinary surgeons. It would be a pity if such a remark should set his professional brethren against the good work he is doing so well.

The text of the pamphlet is as follows:—

Situated as we are in the centre of one of the largest agricultural districts in England, our attention is constantly drawn to the many preventable (as distinct from the unpreventable) forms of cruelty which take place on farms and in markets.

Overstocking of Cows.—Instead of milking cows regularly every twelve hours, it is common practice, when a cow with a calf by her side and in full milk is to be sent to the market, to leave her unmilked from the morning of the previous day to mid-day of the day of the sale. That is to say, she remains unmilked for 20 or 30 hours. Consequently these cows are sent to market, often driven many miles by road, with "bursting" udders and the milk frequently running away. Every farmer does it and knows that every other farmer does it, therefore no one but a fool is deceived into thinking that the cow is a better milker than she really is. This would be cruel treatment in the case of a wild cow, giving a limited quantity of milk during only a portion of the year. But in the case of the heavy milkers which man has evolved for his own purpose, with tremendously over-developed udders, needing a much increased vascular and nervous supply, such treatment can only be classed as very cruel.

The stock arguments of the defenders of this practice are, that if a cow with an over-distended udder is chewing her cud, and able to allow the surplus milk to drain away, although she may be uncomfortable she is in no actual pain. Many veterinary surgeons hold this view, but such have, I think, a conscious, or unconscious, bias in favour of the views of the farmers, their clients, or they have never thought the question out from the standpoint of comparative physiology and pathology. A man with toothache does not refrain from masticating his food when hungry! The milk is normally kept in the udder by the closure of a small circular muscle, and if the pressure within the organ is sufficiently great to overcome this resistance, it surely must result in pain. Every nurse and doctor I have discussed this matter with take this humane and logical view. To clinch their argument they have often said to me: "Ask any nursing mother."

One further point: the most common, troublesome and painful disease of milking cows is inflammation of the udder, which often fails to yield to any treatment and sometimes leads to the death of the cow. These cases are regular bugbears to the country veterinary surgeon. I have reasons for believing that some of these cases are caused by overstocking. All veterinary surgeons are agreed that overstocking has a disastrous effect on the future milking capacity of the cow, and for this reason alone it should be stopped.

Cruelty to Calves.—The normal demand for milk is so great that calves must be born very much in excess of the numbers needed for meat and dairy purposes. Calves should be killed for veal when about six weeks old, but many are slaughtered when very much younger than this. Sometimes they are sent along to the slaughter house directly they are born, and never receive any food at all. But, in most cases, they are left with the mother for some days. It does not pay the farmer to keep them for any length of time on whole milk, and they are taken from the cow and fed on skim milk, or separated milk with cream substitutes added. Often when sent for slaughter they are previously kept for long periods without food and driven sometimes by road. If sent to market with the cow, they are not only starved for many hours, but are often driven, thirsty, hungry and tired, long distances by road to and from the market. Many farmers will not pay the drovers until they deliver the calves, however weak and exhausted, at their destination. Needless to say, calves, like young babies, need frequent small meals; infrequent large meals give them severe indigestion with severe pain, leading in some cases to death.

In short, it should be unlawful to keep a cow longer than twelve hours without milking, or to keep young calves for longer than five or six hours without a meal, while the latter should not be driven along a high road except for quite small distances.

Exposure of Animals During Inclement Weather in open fields with no shelter from thick hedges or trees. Even wild animals always seek such shelter and they are much hardier than domesticated ones. Unbroken colts will die unexpectedly from undiagnosed lung disease, caused by undue exposure. Such cases are often ascribed to lightning, unless a *post-mortem* examination has been made.

Pigs Kept in Filthy Sties.—Because pigs take an occasional mud bath (like elephants and other animals) they are too often kept in filthily dirty sties although they are very susceptible to cold and damp, and benefit greatly from dry and warm surroundings.

Cruelty to Poultry.—Poultry, geese and turkeys are often killed by young, inexperienced and callous persons in a cruel manner, whereas there is quite a simple method described in one of our pamphlets. I believe the slow and cruel process of cutting their throats is still sometimes practised.

(At the request of Captain C. W. Hume, the Secretary of the University of London Animal Welfare Society, I am carrying out some enquiries and investigations into the subject of avoidable cruelties to farm animals. I should welcome further information from any of our members.)

Correspondence

THE FINANCE OF VETERINARY EDUCATION

To the Editor of the Veterinary Record

Sir,—Thank you for your courtesy in sending me your issue of this week containing Mr. Hall Masheter's letter.

There is only one statement in it which is worth while correcting. It is that contained in his third paragraph. The Mansion House Conference was arranged (*a*) to ask for £40,000 to complete the Royal Veterinary College, (*b*) to suggest the desirability of the formation of a National Pool. (*b*) did not arise on the spur of the moment, but only after I had suggested it to, and discussed it carefully with, both the Minister for Agriculture and my colleagues on the County Councils Association. Suggestions involving the Treasury and all the County Councils could hardly be made without careful thought.

It has been agreed now by the Minister of Agriculture, the Secretary of State for Scotland, and the County Councils Association, that this question must be left until the report of the committee on Veterinary Education now sitting is received.

The re-building of the Royal Veterinary College and the extension of the "Dick" College are mere futilities unless each has in the future an assured income sufficient for its staffing and maintenance—and that must not be left entirely to the whim of charity.

Yours faithfully,

Merrik R. Burrell.

Floodgates,
West Grinstead,
Horsham.
February 13th, 1937.

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THE "ACCREDITED MILK" CONFERENCE

To the Editor of the Veterinary Record

Sir,—For many years Dr. W. G. Savage has been a critic of veterinary activities in connection with tuberculosis; indeed, in 1929 he published a book with "The Prevention of Human Tuberculosis of Bovine Origin" as the title. The book is a masterly survey of the whole subject of its title and on the whole is interesting and instructive. As usual, it leads up to pasteurisation as the "be all and end all" of the prevention of tuberculosis of bovine origin. Since it was written what progress has been made by the medical profession to establish pasteurisation on sound principles? How many pasteurising plants are there that are scientifically controlled? If the medical profession believes in this matter why doesn't it "get a gate" as they say in Lancashire?

In one paragraph in his book Dr. Savage states: "It is better for those concerned with the human infection side to face their own problem in their own way [are they doing it?]: to leave bovine tuberculosis to those concerned with animal diseases and to protect the milk supply by an efficient and adequately controlled system of pasteurisation." Has Dr. Savage got the preponderating weight of medical opinion on his side? What efforts are being made by the medical profession to produce this "efficient and adequately controlled system of pasteurisation?" Whether one believes in pasteurisation or not, it is a matter beyond dispute that supervision of the milk supply at its source is necessary—for what is the use of pasteurising hair, blood and cow dung in milk let alone all the pathological germs that may get into milk where no veterinary inspection or supervision ever occurs? Keeping milk *as clean and healthy as possible at the source is the first paramount step to be taken* (even when that "efficient" pasteurisation which Dr. Savage desires is an accomplished fact) and this desirable end is what veterinary surgeons, sanitary authorities and educated cow-owners are endeavouring, with a great amount of success, to do.

Yours faithfully,

G. Mayall, M.R.C.V.S.

Bolton.
February 14th, 1937.

Diseases of Animals Acts

SUMMARY OF RETURNS

Period.	Anthrax.		Foot-and-Mouth Disease.		Parasitic§ Mange.		Sheep Scab.	Swine Fever.	
	Outbreaks confirmed.	Animals attacked.	Outbreaks confirmed.	Animals slaughtered as diseased or exposed to infection.	Outbreaks reported by the Local Authorities.	Animals attacked.	Outbreaks confirmed.	Outbreaks confirmed.	Swine slaughtered.
	No.	No.	No.	No.	No.	No.	No.	No.	No.
Period 16th to 31st Jan., 1937	29	32	1	119	14	24	18	54	42
Corresponding period in									
1936	20	40	2	37	8	14	22	108	49
1935	19	21	16	3,834	11	11	37	80	26
1934	18	18	—	—	20	31	75	111	72
Total 1st January to 31st January, 1937	58	65	2	178	22	32	51	103	59
Corresponding period in									
1936	46	67	4	379	17	28	62	215	108
1935	37	40	17	3,914	26	33	83	143	50
1934	30	30	—	—	34	56	162	174	99

Note.—The figures for the current year are approximate only.

§ Excluding outbreaks in Army Horses.